April 1959

Agriculture

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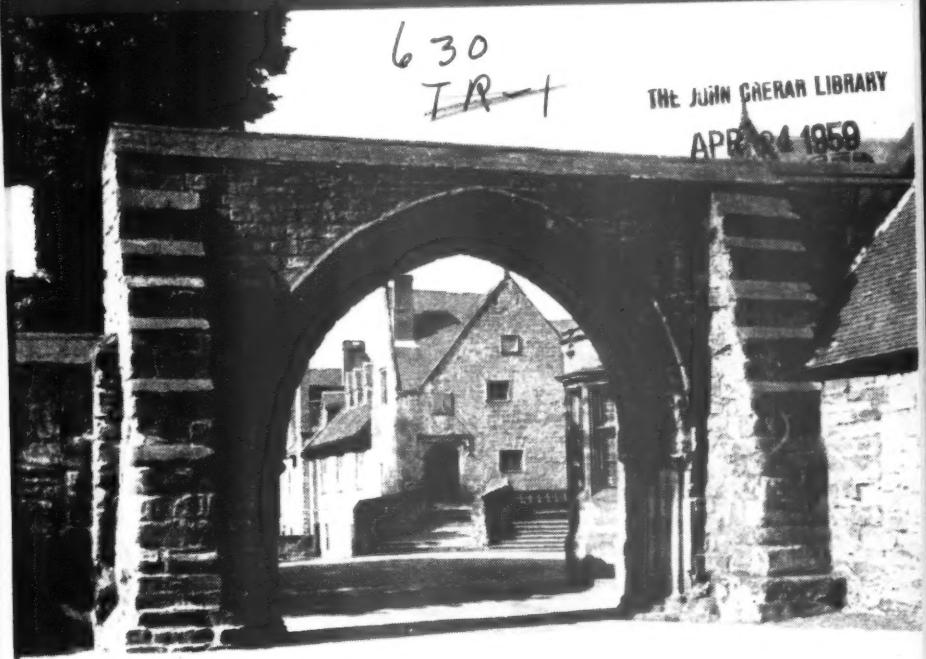

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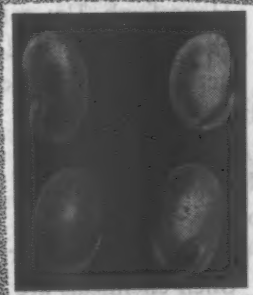

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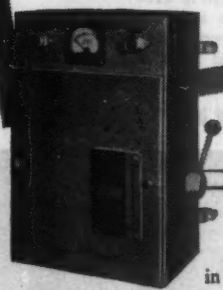

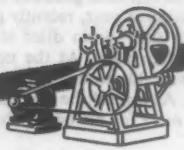

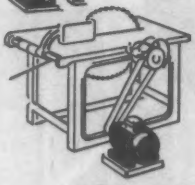

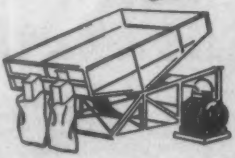

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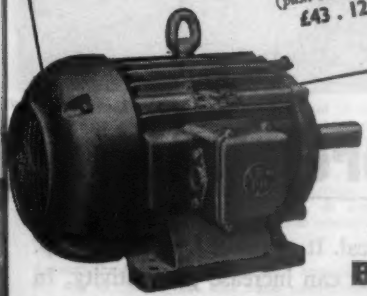

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Science and the Hill Farmer

A. R. WANNOP, O.B.E., B.SC.(AGR.)
Director, Hill Farming Research Organization

Many of the hill farmer's problems—for example, the decline in carrying capacity of his hill pastures, adequate winter feeding of his ewes, and mortality among lambs—may be solved by co-operation between the research worker and progressive farmers.

UP to the second world war, hill farming received little attention from scientists. There was active research into sheep diseases, but in other fields the work tended to be spasmodic. Output from hill farms is, of course, only a small part of the national farm product, and research work in general affects all types of farming, but despite this the question of how hill land could contribute more to our food supply got less attention than it deserved. Now national needs have altered this outlook, and investigations into hill farming problems are active at several centres.

Every hill farmer would like to produce more from his hill, provided that in doing so he satisfies two conditions. His efforts must in the long run be profitable and they must in no way affect adversely either the health of his hill flock or its inclination to range the hill and so utilize it to the full. In endeavouring to make any improvement, however, the hill farmer is severely handicapped by the inherent poverty of hill soils, by high rainfall and low temperatures, especially in winter, and by steep gradients and rough terrain. These are such that the cost of altering the environment to allow hill animals to show their full genetic potential is often prohibitive. Whereas a lowland livestock farmer can adapt the environment in which his animals produce meat or milk or eggs so that they give their highest production, the hill farmer all too often has to adapt his animals to the environment.

Hill farming varies enormously, of course, and it covers a wide range of conditions. Its one common feature is a flock of hill sheep, to which there are very few exceptions. But the management of hill flocks varies very greatly. In the north of Britain they usually live on the hill all the year round, including the lambing period. Elsewhere they may lamb off the hill, and in some areas spend a good part of the winter and spring in enclosed old or reseeded pastures.

Winter problems

Whatever the wintering practice, one of the hill farmer's main problems is that of adequate flock nutrition in winter. From December to early May most hills provide less than the ewe needs for maintenance, pregnancy and early lactation, the peak of deficiency usually being in February, March and April. The acidity of the soil, rainfall and cold cause hill growth to decline severely in most winters, and much of the herbage becomes fibrous and indigestible. To these conditions, the ewe adjusts herself by restricting her intake. She still hunts for green blades of grass, eats the few she can find, and sup-

plements them by basal shoots from plants neglected in summer. Selective feeder though she is, she cannot avoid ingesting some fibrous material. The total nutrients she gets from this diet are usually insufficient and, depending on the hardness of the winter and the quality of the grazing, she may at the end of March be from 10 to 30 per cent lighter in weight than she was in November: and this despite the fact that she is pregnant.

We treat no other farm animals in this way. Fortunately, through generations of breeding, hill ewes have developed a "hardiness" which enables them to stand up to these conditions with a degree of mortality that is on average about 5 per cent. This ability to adapt herself to conditions of plenty in summer and poverty in winter is a great attribute in a hill ewe, but it is not without its price. In general, single lambs must be the rule, since hill ewes are not fit enough at lambing to nurse twins satisfactorily. Then too many lambs are not well enough developed at birth to withstand the rigours of the hill, and they succumb quickly. Thus, even allowing for some twins, the national average of hill lambs weaned per hundred ewes mated is only about 80 per cent, and in many poorer hill regions only 60 per cent.

Can science help to overcome these difficulties? Hill ewes are capable of greater production, as their performance proves when they are taken to lower ground. The ideal hill farm might be one with sufficient enclosed and tillable land to let the flock spend part of the winter on improved grass, possibly with some forage crops, lamb there and return to the hill when the lambs are a week or two old, leaving ewes with twins for six weeks or so longer. Under such conditions more ewes could be kept and more and better lambs reared. Most genuine hill farms, however, have too little enclosed land to do this; they can only bring some of the weaker ewes, and possibly those carrying their first lambs, off the hill for rather better treatment. It is on hills such as these, where the flock must be kept on the hill all the year round, that the real problems arise.

Improving the hill

Naturally one thinks first of improving the hill. It is generally agreed that hills today are incapable of carrying as many sheep as they did a hundred years ago. This is partly due to the disappearance of wethers which, with no pregnancy and lactation demands, could graze hills that are not suitable for ewes. But it is also due to our policy of extractive grazing. We remove an annual crop of wether lambs, surplus ewe lambs, cast ewes and wool from land of low fertility and put little or nothing back in the way of replacement minerals. Admittedly, the annual drain is not much, but it is bound to be cumulative. Then the sheep is a highly selective grazer. It can pick out the newly growing shoots of the finer grasses, and when it does this every spring it leaves good sheep plants less vigorous and less able to withstand competition from coarser, unpalatable plants which are not defoliated by sheep at this critical period each year. Every decade the less valuable sheep plants become more dominant. This decline in sheep carrying capacity is thus a combination of lowered soil fertility and a gradually coarsening herbage.

To arrest this decline, and if possible reverse it, is the main challenge to scientists and hill farmers. On selected areas that can be fenced, ploughing and reseeding is possible and is now an established practice, but it is inap-

propriate for the open hill. Mixed grazing of cattle and sheep is a help. Cattle remove coarse and fine herbage more or less equally and maintain a better balance. In fact, if judiciously used they can kill out some undesirable plants, but good management is needed to see that these are replaced by better and not inferior ones. Provided they do not compete for the same grass, cattle also benefit the sheep. On part of our Sourhope research farm in the Cheviot hills we have in six years increased the sheep output of one hill by 30 per cent by introducing cattle and without increasing the ewe stock. More and better lambs and reduced mortality have resulted, and in addition we have sold as much weight in weaned calves as in lamb, cast ewes and wool. The gross production has more than doubled. This has been possible on a hill where the sward is principally agrostis/fescue, molinia, nardus and some bracken. A similar result could not be secured on a hill with heather, molinia, rushes and the plants of peaty soils and higher rainfalls. Cattle must be used on hills with discrimination if they are to be beneficial to the hill and profitable at the same time.

An improvement of this type is the result of one form of grazing control. We may have to try others to prevent hill deterioration as well as to increase production. Our forefathers last century had the advantage of plenty of shepherds, especially before compulsory schooling. Sheep and cattle were carefully husbanded so that they grazed different plant communities at different seasons. Areas were carefully saved from grazing to be of value later at crucial seasons. In summer, stock were kept up the hill, so that the low ground was saved for winter. Now the scarcity of shepherds leaves the flock freer to graze at will. In New Zealand, where there are far fewer shepherds than here in relation to sheep numbers, flock and grazing control is done by extensive fencing. Hill fencing is costly and winter storms need to be kept in mind, but using the latest fencing techniques might give a sufficiently greater production from the better utilized grass to cover the costs and more. New Zealanders maintain they can double their sheep stocks merely by fencing.

Fertilizer and feed

Some time or other, everyone thinks of fertilizing hill land and of aerial top-dressing. Again, New Zealand is an example of progress in this field. But their conditions are really different in both soil and climate. On hills bearing any resemblance to ours they do very little. But this is no reason for our inactivity, and the possibilities should be explored. However, plots on the hill at fourteen centres spread from Wales to the North of Scotland showed that the light dressings from which a response is obtained in New Zealand have no effect at all here. There seems no escape from the more typical British rates of application, and while some better hill areas may respond to phosphate only, the vast majority need 2 tons or so of lime before the phosphate will give its best return. In New Zealand, where the response is so much quicker and more striking, they would not normally use aircraft for distributing more than 5 or 6 cwt per acre. Our problem is to get the first heavy dressings applied on hill ground, following which aerial application of light maintenance dressings to keep the improvement going would certainly be feasible.

Even if we could put so much lime and fertilizer on a hill easily, we should

have to make sure that we could stock the hill to get an increased annual return to cover the costs. At hill altitudes we would still have restricted winter growth and be left with a "hungry gap" period, though it might be less lengthy than now. On farms with little enclosed and improved land the feed available on the hill in March would still determine the number of ewes to be carried. This is where supplementary hill feeding has to be considered. For this purpose, hay is the traditional food. It is given in snow-storms and on some farms at other times. If it is green, leafy and of high quality, it is excellent and difficult to equal, but good sheep hay is difficult to find in our mechanized age, with heavily fertilized hay crops grown from modern seeds mixtures. Artificial hay drying, despite the slow throughput, may be the answer. But hay is bulky, and if the ewe is still to range the hill we must leave her with an unsatisfied appetite after her supplementary feed.

Hence the interest in using concentrated foods in small quantities. Our research efforts on feeding do show some response to such feeding, but it is limited except in flocks of low lambing percentage, where we can increase lamb crops by 12 to 15 per cent. The main advantage is in reduced mortality at lambing, rather than in much increase in weaning weights. There are many questions to resolve on supplementary feeding. Small quantities of a concentrate in cube form do not stop the ewe ranging, but the long term effects need to be studied. The protein content of the concentrate also needs consideration, but unfortunately it is difficult to determine the protein and energy content of the actual hill herbage which the ewe eats, so that we do not know the deficiencies which need to be made good.

Good hill farm management has always involved the maintenance of the hill in good condition for sheep by surface draining and by controlling bracken. Nearly thirty years ago workers in the West of Scotland showed that mechanical cutting or bruising was effective in reducing bracken infestation if it was done twice a year at critical stages in plant growth for three or four years. More recently an economic survey has demonstrated the financial advantage from such treatment. But mechanical control is not in itself final and has to be resumed as the bracken recovers. Nor can it deal with bracken in gullies and in very rocky areas. Modern chemical sprays may in time give us a better solution to the bracken problem. Some quite effective materials are now under trial, and though questions of cost and methods of application still arise, it is reasonable to be optimistic about the possibilities of a far more effective bracken destroyer than we have as yet known.

No panacea

In a modern approach to hill improvement, the interactions of animal and herbage must be studied if we are to prevent poorer hills from declining. This is important on all hills, but the better ones may respond to expenditure on known improvement techniques, whereas poorer ones are unlikely to justify such a step and will depend for any improvement on grazing control. We need to know more about the plants that sheep favour at different seasons, and whether preferences are the same for all the sheep in a flock as well as for different breeds. If any special plant community serves little or no purpose at any season, can it be changed? Some small-scale trials with hormone chemicals suggest that it is easy to remove rough undesirable

herbage by spraying and replace it with better grass without a lot of mechanical effort, but large-scale trials will be necessary to decide whether it is profitable. Another question, on hills with varied herbage where fertilizer can be applied, is whether all the expenditure should be on the palatable agrostis/fescue areas or all on the less palatable sheep plants, such as molinia and nardus, or evenly over the whole hill. If, by manuring, one could make the less palatable grasses more attractive to sheep, should they be treated first?

In a short article such as this, one cannot cover every aspect in which science touches on hill farm management. An attempt has merely been made to indicate some of them, and no reference has been made to many others of equal importance. Thus no mention has been made of breeding, and of the many nutritional and health problems which exist. It is hoped, however, that sufficient has been said to make clear that scientific research can play a part in hill farming, and that by the co-operative efforts of progressive hill farmers and scientific workers the possibilities of increasing output from upland and hill farms are likely to be realized.

Broken Mouth in Hill Sheep

PROFESSOR A. D. HITCHIN, D.D.SC., M.D.S.
Dundee Dental School, University of St. Andrews
and
J. WALKER-LOVE, B.SC.(AGRIC.), M.S.
West of Scotland Agricultural College

Broken mouth—the loss of incisor teeth—can be made less common by breeding from tups with the right type of mouth. The writers of this article explain what to look for.

BROKEN MOUTH, or the loss of incisor teeth, is not uncommon in hill sheep, and the farmer can lose a great deal of money when it occurs in his breeding ewes. A broken-mouthed ewe cannot crop enough from a hill to support both herself and a lamb, and must be sold either for slaughter or to a lowland farmer, whose pasture can be cropped without incisors.

Loosening of the teeth, resulting in their falling out, is a form of parodontal disease comparable to pyorrhoea in man, but it is not necessarily due to the same causes, though similar principles will apply.

Dental anatomy of the sheep

The adult sheep has four incisiform teeth on each side of the lower jaw—three being true incisors, which bite on, into or near a large, hard pad of gum on the front part of the upper jaw. There are six back teeth on each side of both jaws, composed of the three dental hard tissues—enamel, dentine

and cement—so distributed that unequal wear produces a rough grinding surface.

When the sheep is ruminating with the cheek teeth of one side, it is not using either those on the opposite side or the incisors. Likewise, when the incisors are being used to crop the grass, the back teeth of both sides are out of action. Such an arrangement is common in ruminants and is protective: if during the long periods of cropping and ruminating all the teeth of a sheep were grinding at once, the strain on the supporting tissues would be so great that they would be damaged, without sufficient time for repair. In other words, the teeth would become loose and fall out. Moreover, the incisors are not firmly fixed in their sockets and there is a degree of normal mobility.

Stress, if excessive in degree or abnormal in direction, frequently causes the gum to recede or lengthens the exposed part of the crown of a tooth. Moreover, the length of the incisor crowns is also influenced by the angle and amount of wear due to use at the cutting edge. In dental circles this is known as attrition.

How the incisors meet the maxillary pad will influence the direction of the stresses to which they are subjected. In one well-recognized abnormality known as "sow mouth", the incisors bite behind the maxillary pad, and shepherds, recognizing its hereditary origin, get rid of lambs showing such an occlusion.

There are three types of normal occlusion of the incisors with the pad. In the first, the incisors bite into the pad so that the stress is more or less axial; they become worn by attrition and produce surfaces at right angles to their long axes (see p. iii of the art inset). In the second type the incisors close on to the front of the pad of gum, so that the stress is oblique and through attrition they assume a sharp chisel-like bevel facing backwards. In type 3 the incisors stand completely in front of the maxillary pad, which closes on the gum behind them. Short grass cannot be cropped, but longer grass is snapped over the incisors after being gripped between the pad and the gum behind them. They thus become worn to a ragged bevel facing forwards.

Investigation into broken mouths

An invitation was received in 1947 to investigate the higher incidence of broken mouth in certain Cheviot flocks in Nithsdale, Dumfriesshire. In the past, only 1 per cent of ewes cast at 5½ years had broken mouths, whereas in 1943, 50 per cent of this age group had lost teeth, and loosening was occurring at three years old.

No similar trouble had been observed in Blackface flocks living in an apparently similar environment in adjoining parishes, and no early loss of teeth had been noticed. A study was therefore made of the mouths of random samples of lambs and ewes from both Blackface and Cheviot flocks in Nithsdale.

Type 1 occlusion was so common in the Blackface sheep examined, occurring in 94·2 per cent of the lambs and 87·1 per cent of the ewes, that it seemed justifiable to regard it as normal for the breed. On the other hand, the Cheviot sheep displayed only 47·7 per cent of Type 1 occlusion in lambs and 9·9 per cent in the ewes.

It is true that Type 1 occlusion in both breeds was commoner with

temporary teeth than with permanent, for the incisors tend to move forward as age advances. Nevertheless, if permanent teeth with Type 1 occlusion become loose and drift forward to simulate Type 2, the right-angled worn edge enables the discriminating observer to recognize it. This is not common, however, but may occur if a mat of grass forms around the teeth.

If an artificial crown is fitted to a sheep's incisor in such a way that the stresses become oblique, the tooth becomes increasingly mobile and the crevice around it deepens. This is characteristic of parodontal disease. It therefore seemed reasonable to explain the higher incidence of broken mouth in the Cheviot ewes in Nithsdale compared with the Blackface ewes in a similar environment by the different occlusions observed.

Moreover, hill farmers told us that in their opinion the condition is worse if turnips are fed during the winter. This is consistent with the suggestion that the direction and amount of stress are important: turnips would undoubtedly have a greater effect on the teeth of ewes with Type 2 occlusion. When a pedigree Suffolk flock was examined (a breed traditionally fed on roots) it was found that all had Type 1 occlusion.

Breeding experiments in Cheviots

It seemed probable that the type of occlusion would depend on hereditary factors, and a search was made for Cheviot tups with Type 1 occlusion to serve the Cheviot ewes, 90 per cent of which had Type 2 occlusion. The results are recorded in Table 1. It will be seen that 71·5 per cent of the lambs had Type 1 occlusion, compared with 47·7 per cent in the random samples.

Table 1

Lambs obtained by Type 1 tups out of Type 2 ewes

Sire (Type 1)		Total lambs	Type 1	Type 2	Type 1 *per cent*
"Myredykes"	1948	46	35	11	76·1
"Myredykes"	1949	50	30	20	60
"Jet propelled"	1948	29	20	9	69
"Jet propelled"	1949	21	19	2	90·5
2 unnamed Type 1 tups		100	73	27	73
		246	177	69	71·5

Later our attention was drawn to a Blackface flock in Lanarkshire with early loss of teeth from parodontal disease. Whereas in 1921, 5 per cent of the 5½-year-old cast ewes had broken mouths, in 1950, 39·2 per cent had lost incisor teeth. When a random sample of ewes from this flock was examined for occlusion, only 37·2 per cent were found to have Type 1, compared with 87·1 per cent in the Blackface flocks in Nithsdale. Moreover, of the tups that had been used, only three out of nine showed Type 1 occlusion.

Nutritional deficiency a possible factor

It is not contended that occlusion in the sheep is the only important cause of broken mouth. There is some evidence that calcium phosphorus imbalance in the diet may lead to a greater number of "undershot" jaws.

Furthermore, a calcium phosphorus imbalance and mineral depletion may occur in hill ewes in the late winter, because of poor nutrition while bearing a lamb. In view of these considerations, the late Dr. G. Dunlop suggested the trial of massive doses of vitamin D.

For this purpose, 45 ewe lambs on one hill in the Lanarkshire Blackface flock were dosed on six well-spaced occasions with 2 million international units of vitamin D. A similar number of ewe lambs on the same hill were kept as controls. The results of their dental examination when cast at 5½ years and the dates of dosing are shown in Table 2. From the table, it is evident that 36·1 per cent of the dosed ewes and 42·2 per cent of the undosed had abnormally mobile incisors. The difference is insignificant. It will be noted that the dosed showed more with broken mouths than the undosed.

Table 2

Results of the examination (Sept. 1958) of ewes dosed with 2m. i.u. vitamin D in October 1953, November 1954, April 1955, April and November 1956, and September 1957, and controls all born in 1953.

	Dosed			Undosed			Dosed and Undosed	
	Type 1	Type 2	Total	Type 1	Type 2	Total	Type 1	Type 2
Broken mouth and abnormal mobility	0	7		0	5		0	12
Abnormal mobility	2	11	13 (36·1 *per cent*)	6	13	19 (42·2 *per cent*)	8 (18·2 *per cent*)	24 (64·8 *per cent*)
Normal mobility	15	8	23	21	5	26	36	13
Total	17	19	36*	27	18	45	44	37

* Four ewes had been removed to another flock, and others were missed at the gathering

No improvement in the incidence of parodontal disease resulted from the administration of massive doses of vitamin D at the intervals described.

When, however, this table is examined from the point of view of occlusion, it is seen that only 18·2 per cent of the ewes with Type 1 occlusion displayed abnormal mobility, whereas 64·8 per cent of those with Type 2 occlusion had loose incisor teeth. The figures for broken mouth are also conclusive—none of the 44 Type 1 ewes had lost teeth, whereas 12 out of 37 of the ewes with Type 2 occlusion had broken mouths.

It seems that broken mouth and parodontal disease are more likely to occur in hill sheep with Type 2 occlusion than in those with Type 1. In hill flocks, therefore, tups with Type 1 occlusion should be selected for breeding.

Grateful acknowledgment is made to the farmers and shepherds who co-operated in this investigation.

The Future of British Potato Farming as I See it

SIR THOMAS A. WEDDERSPOON
Castleton of Eassie, Forfar, Angus

In the writer's view, the future of the potato industry rests largely on a higher production of home-grown potatoes, well washed and attractively presented. Sir Thomas writes from first-hand experience on his 1,000-acre farm in Scotland.

MANY millions of pounds have been invested in the mechanization of British farming to meet the ever-dwindling labour force on the land. For cereals, the numbers of combine harvesters and balers have increased immensely since 1938, and farm grain driers and storage facilities are keeping pace. So, too, with our sugar beet. The introduction of precision seeder drills has reduced labour requirements in singling. Machines which cleanly harvest the tops for stockfeed have made the sugar beet crop an increasing asset in areas where livestock farming predominates. A wide range of beet harvesters has completed the mechanization. With this crop, the farmer has no further capitalization requirements, since an efficient British Sugar Corporation, with its eighteen factories, does the rest.

The same can be said for the pea crop for canning and freezing, which has made great strides since the war, and the harvesting has become highly mechanized. Several well-known national organizations have put substantial sums of capital into farm viners and the necessary canning factories and freezing plants, so that here again the farmer has no further capitalization requirements, and contracts to grow are keenly sought after. But what can we say about the potato industry?

First a word on mechanization. The complete mechanization of the harvesting of potatoes for human consumption has so far baffled most countries in the world. It is true that there are machines which will operate satisfactorily in small areas where, given favourable weather, soil conditions are suitable, but their application is distinctly limited. Broadly speaking, we still use the same tools as we did twenty-five years ago. But even more serious is the presentation of the product. In amplification of what follows, I must first quote some statistics.

Imported or home-grown?

As one of the original members of the first Potato Marketing Board in 1933, I can speak from practical experience. Despite the fact that we had not lost all our foreign investments, the policy of successive Governments at that time was to give the potato industry a substantial degree of protection if it would put its own house in order by the introduction of orderly marketing and the allocation of basic acreages, etc. The total import figures of all potatoes, new and old, for the seven years 1933–39 are interesting:

Year	Total *cwt*	Total price £	Price (*per cwt*) *s.* *d.*
1933	3,928,090	2,063,403	10 6
1934	3,077,047	2,091,052	13 7
1935	3,816,087	2,778,933	14 7
1936	6,327,551	3,082,600	9 9
1937	4,446,179	2,282,277	10 3
1938	2,923,124	2,049,984	14 0
1939	2,923,075	2,034,508	13 11
Total	27,441,153	16,382,757	
Average for 7 years	3,920,165	2,340,394	11 11

The import duty paid as from 5th May 1933 was:

New potatoes

1st November–30th June	4*s.* 8*d.* per cwt
1st July–31st August	£2 per ton
1st September–31st October	£1 „ „

These rates continued up to 1947

Old potatoes

1st July–31st August	£2 per ton
1st September–30th June	£1 „ „

These rates continued up to 1947

The position today has changed considerably, as the undernoted figures clearly show:

Year		Total *cwt*	Value £	Price (*per cwt*) *s.* *d.*	*Total* £
1955	New	5,246,497	9,866,827	37 7	
	Old	3,171,001	2,469,345	15 7	12,336,172
1956	New	4,498,308	10,953,150	48 8	
	Old	6,214,306	8,032,620	25 10	18,985,770
1957	New	4,803,453	9,177,976	38 3	
	Old	283,910	249,084	17 6	9,427,060
1958	For 7 months ended 31st July				
	New	5,274,870	13,333,961	50 7	
	Old	6,977,236	7,626,144	21 10	20,960,105

The 1959 imports of both new and old may well exceed the 1958 figures.

The applicable import duties paid today and during the past four seasons have been:

As from 1st December 1953 to date:

	per cwt *s.* *d.*
New potatoes	
16th May–30th June	9 4
1st July–31st August	2 0
1st September–15th May	1 0
Old potatoes	
16th May–30th June	1 0
1st July–31st August	2 0
1st September–15th May	1 0

Why this vast annual outpouring of sterling for potatoes? In their efforts to redress the balance of the short crop harvested in the autumn of 1955, home growers planted an increased acreage and, with a higher than normal yield in 1956, produced a surplus which cost the British taxpayer £15·1 million. Still we imported almost double the weight of new potatoes that we had been consuming just before the war.

A product for the housewife

Can it be that the imported product, particularly as far as new potatoes are concerned, is presented in a more attractive form to the housewife? We have been insisting on many new imported potatoes being washed, and perhaps the housewife is slowly being educated to consider the weight of potatoes she puts into the pot, as distinct from the weight she buys and carries home.

I have had some very interesting experiences myself during the past two years. The washing and treating of seed potatoes and the washing of ware potatoes starts on my farm at the beginning of September, but I must point out that the potatoes are *mature*. The skin is firm and set. The tubers are thoroughly washed under a series of high pressure jets which remove every trace of soil, even from varieties with deep eyes. They are more cleanly washed than any housewife could possibly wash them. The workers in the field picking the potatoes place them straight into wooden barrels which are lifted with hydraulic hoists on to trailers or lorries and are hauled anything from two to thirty miles into the washing plant. In this way damage is minimized. "Blights" and "green ends" can be picked out after washing with the greatest of ease on a series of slow-moving plastic-covered rollers. For the final washing, clean borehole or reservoir water must be used. This is important, and sooner or later the Public Health Authorities must take action on this point. Finally, the tubers are thoroughly sponge dried. There has been a great deal of nonsense talked about washed ware potatoes. Mature samples properly washed and graded will keep for a month or more if they are finally washed with clean water, properly sponge dried and can be packed in new 7½ oz hessian sacks holding 1 cwt each.

The method of stacking and ventilation is also important. In the autumn of 1957 I held 400 tons for a month handled in the foregoing manner, but there was no need to do this last year as, with a keen demand, my daily output was cleared every morning. What made me rather sad was when the housewives in Glasgow started searching the shops for the product (I marketed over 580 tons in Glasgow in eight weeks) and kept asking for "those washed imported potatoes". They refused to believe that in fact they were grown 90 miles away!

Washing potatoes as harvested out of the ground is one thing, but washing them out of sheds or pits is quite another. In my opinion very little damage is done to the tubers up to the time the worker picks them off the ground. Prudent supervision and control of the speed and setting of the harvesting machine, whether a spinner (and there are many types) or a chain elevator digger, can achieve much. It is from the time that the potato has been hand picked that the real trouble begins. Some growers take the trouble to minimize this damage, but they are few.

At the moment, dry brushing of ware potatoes is popular. It is merely a make-shift, but it is an improvement upon the method of presenting potatoes that has been used over the last hundred years. In a wet autumn, when much of the crop is lifted under bad conditions, dry brushing removes a lot of the soil.

Whether he likes it or not, the British potato grower must face the fact that great changes are on the way. The rapid increase in the number of super-markets and self-service shops will call for a clean, well-graded product. It is difficult to see what form this new system of marketing will take and where the capital will come from to develop it. Perhaps some of our well-known names in the food distribution trade will themselves directly or indirectly become interested. Presumably we shall not continue to import anything from 10 to 20 million pounds worth of potatoes each year when in point of fact we can produce all that we require at home, other than a few *so called* earlies for the luxury trade. Our main weakness is that we have no factories to deal with a surplus crop in the same manner as many Continental countries. In plain language, the potato crop from the beginning to the end has not adequate capital resources. We are trying to do a twentieth-century job with nineteenth-century equipment. Compare the modern capital invested with that of cereal growing, the sugar beet industry or the pea canning and freezing industry.

Washing of seed potatoes

A last word about the seed trade. There is a substantial world market for high-quality seed potatoes, but the importing countries are steadily raising their standards. We are demanding that imported early potatoes from many countries be washed, so in turn they insist that the seed shall be free from soil, or to quote from one typical regulation

> The landing of seed potatoes is prohibited unless—(a) they have been found on arrival to contain not more than one half per cent by weight of soil or tubers affected by the disease known as late blight (*Phytophthora infestans*).

The washing and treating of seed potatoes for the world export markets becomes more imperative every year. It will probably be the only method by which it will be possible to ship to many countries when international agreement at the scientific level has been reached.

Proper washing of mature seed tubers can guarantee freedom from seed-borne potato root eelworm, oat eelworm, wheat eelworm, beet eelworm and pea eelworm. Farmers have been using mercurials for dressing their wheat, barley, oats and other crops for over twenty years.

Professor Muskett of Queen's University, Belfast, did work on potatoes more than twenty-five years ago, and it is only now that this work is being put to practical account.

Washed and treated seed potatoes can be guaranteed to be free from dry rot (*Fusarium caeruleum*) and skin spot (*Oospora pustulans*), two very troublesome diseases. A twelve-minute immersion, followed by proper grading, can make a crop infected with rhizoctonia (*Rhizoctonia solani*), brown scab (*Actinomyces scabies*) or corky scab (*Spongospora subterranea*) disease-free. Late blight can be completely removed from a seed sample. It is so easy to detect when washed.

No doubt, capital will come forward to develop these washing and treating plants in the areas where they should be erected, but if it is as slow in materializing as for the rest of the potato industry, we may well lose many valuable seed export markets and continue to import vast quantities of foreign so-called "new potatoes", which in my opinion could be eliminated by presenting to the British housewife what she is looking for—good quality washed and properly graded home-grown potatoes.

Barn Hay Drying

C. CULPIN, M.A.

Chief Farm Machinery Adviser, Ministry of Agriculture, Fisheries and Food

In our uncertain weather, haymaking by the usual methods is not always feasible. In this article Mr. Culpin draws attention to the possibilities of making hay, either loose or in bales, under cover.

AFTER an unusually wet summer it is not easy to recall June 1957, when most of the country enjoyed a long spell of perfect haymaking weather, such as perhaps we may not experience again for many years. The result was a large quantity of good hay, which helped considerably in getting an unusually high production of milk and excellent growth rates in all kinds of cattle the following winter. If we could always make good hay as easily there would be no future for barn hay drying, but 1958 provided such a contrast that there must be many farmers who are now wondering about the possibilities of barn drying.

It should be emphasized at the outset that, on most farms, barn hay drying and making silage are complementary methods of conservation. Cutting for silage at the right time, early in the season, makes barn drying easier than where no silage is made.

Success depends on field work

Moisture is removed from hay, both in natural drying conditions and in farm driers, by carrying it off as water vapour in a current of air. Since the aim is to get the crop dried quickly, the first operation by the mower, which lays the swath down flat on the ground, is by no means ideal. It makes it almost impossible for air to circulate freely around the lower part of the swath. The remedy at present is to use a swath turner, and tedder fairly quickly. At some time in the future we shall doubtless have mowers which, after cutting the crop, treat it so as to secure quick drying. Some types of

forage harvester do this, but unfortunately they also produce many small pieces of leaf which are lost in subsequent operations, with the result that a quarter or more of the most valuable part of the crop may be lost before the hay is collected.

In outdoor haymaking, even if the farmer uses weather forecasts to the best advantage and gets on with early tedding as suggested, it happens all too frequently that the weather breaks before the crop is fit to carry. There is nothing more discouraging than to get the crop practically fit to bale in about thirty-six hours and then watch it getting thoroughly wet again.

The broad aim of barn drying is thoroughly logical: it is to reduce the period of field drying to a length of time over which weather forecasts are usually fairly reliable, and to finish drying in the barn. There is, however, another advantage. Collection of the crop partly dried means that it is taken in complete with the leaves. This means both higher quality and a greater yield—advantages which help to pay for any extra cost.

Aims and methods

Though there is no hard and fast line between barn hay drying and grass drying, the two processes are usually different in objectives. With grass drying, the aim is the rapid drying of young grass or leguminous crops which are so rich in nutrients that a relatively high drying cost can be justified. In barn hay drying the crop is at the hay stage, and though a good barn-dried lucerne hay may show a crude protein content of up to 20 per cent, a typical grass and clover ley cut at the early hay stage will be satisfactory if protein content is in the region of 12–14 per cent.

Hay can be barn dried either loose or in medium or low density bales. Chief advantages of drying in the bale are ease of collection and handling into the drier, the fact that a given drier can hold a larger batch of hay, and ease of handling the product. There are, however, some difficulties which should not be under-estimated. Very damp hay is not as easily dried in bales as in the loose form, and for success it is essential to make bales of a uniform density. Whatever method of barn drying is employed, the time and cost are greatly reduced if much of the moisture can be removed in the field. The reason is well shown by the following figures.

Moisture content of hay when loaded into drier	Weight of water that has to be removed to produce 1 ton of hay at 20 per cent moisture content
per cent	*cwt*
60	20
50	12
45	9
40	7
35	5
30	3
25	1

In practice the aim should be to reduce moisture content in the windrow to 35–45 per cent, but with some types of drier, crops of higher moisture content can be dealt with if necessary.

Methods for loose hay

Barn drying of baled hay is a comparatively recent development, and most of the driers installed until quite recently were designed for drying hay in loose form. Many small dairy farms have little field equipment, and for them barn drying in the loose is likely to remain preferable to drying in the bale. One of the snags about drying loose hay is that it is inadvisable to trample on it at all during loading, so one must either use a forage blower for loading, or, more usually, distribute the crop over the drying bay with a hand fork from a raised platform. This calls for some hard work and a great deal of care, since uniform drying depends on getting the hay evenly loaded.

There are three main systems of drying, and the chief characteristics of each are briefly indicated in the following table. Note that the figures given are intended only as a rough guide.

Types of drier for loose hay

	Cold air deep storage	Medium air-speed with heater	High-speed cold-blow, low-speed warm-blow
Loading depth (*ft*)	16–18; loading in stages	16–18 in stages; 8–10 when heat used	6–8
Loading moisture content (*per cent*)	35–50	35–55	40–60
Drying time in field (*days*)	2–3	2–3	½–2
Air flow c.f.m. per sq. ft at 2 in. water gauge	25	25	60 cold 20–30 warm
Temperature rise	Nil	8–15°F in last stages of drying	Up to 25°F in last stages of drying
Approximate time needed to complete drying (*days*)	15	7–10	3
Typical cost per 300–350 sq. ft bay in existing barn	£200	£250	£500
Typical running cost per ton (all-electric)	10s.–£1	10s.–£2 10s.	£2–£5

A study of the table shows a considerable difference between the normal objectives with the three main types. While the deep storage drier is only suitable for dealing with fairly dry hay, the cold-blow/warm-blow type can successfully dry crops that are brought in after very little field drying.

Where an air heater is used and drying is on a batch system, the potential output per drying bay is increased; and if the floor is suitably designed, the drier can be used for drying grain in sacks. Typical outputs are 10–15 tons per bay for storage driers, 10–25 tons for a medium air-speed plant, and up to about 45 tons for a high-speed cold-blow/low-speed warm-blow plant. All three types of plant have proved satisfactory where management is good, but it seems likely that the barn drying of baled hay will be of more interest to most farmers in the future.

Barn drying of baled hay

Research by the National Institute of Agricultural Engineering and the Electrical Research Association has shown that the barn drying of baled hay has great potentialities, and several farmers in different parts of Britain practised the technique successfully in 1958. There is still a good deal to learn, but sufficient experience has been gained to enable sound advice to be given to any farmer who wishes to build a baled hay drier. As with the barn drying of loose hay, the objectives can be very varied. Most farmers are likely to be interested chiefly in conditioning hay that has nearly dried in the windrow, and as with drying loose hay it is important to stick to reasonable objectives. It is possible to dry baled hay at 60 per cent moisture content in a well-designed and suitable type of plant; but in an unsuitable installation hay at such a moisture content will never dry, and even in a plant designed to deal with fairly high moisture contents it is not likely to be economic to dry bales at much over 50 per cent moisture content.

Whatever the drying system—and there are four fairly distinct ones to choose from—good field work is vital. Special care must be taken to ensure that bale density is uniform, and this means particularly good tedding, as well as a careful watch on the bale tension adjustment. Size of bales should be varied to suit the method, as suggested in the following table, which indicates the main features of the chief types of plant designed from the start for dealing with bales.

Types of driers for baled hay

	Deep storage cold air	Tunnel or portable floor with heat	Medium air-speed bay with heat	High-speed cold-blow/low-speed warm-blow
Loading depth or tunnel wall thickness (*ft*)	Up to 18 in stages	5–9	6–9	4½–9
Suitable moisture content (*per cent*)	35	35–45	45	up to 55
Air speed (c.f.m. per sq. ft except where stated)	35–45	15 to 40 c.f.m. per bale (750 to 2,000 c.f.m. per ton)	45	60 cold-blow 20–30 warm-blow
Bale length (*in.*)	36	30–36	30	24–30
Bale weight (wet) (*lb*)	60–70	60–70	60–70	50–70
Approximate drying time in field (*days*)	2–3	2–3	1–3	1–2
Approximate drying time in barn (*days*)	21	7	7	4–7

It will be seen that the four systems are designed to deal with bales of different moisture content, and the normal objective of the first two may be described as conditioning rather than drying. The following notes indicate some of the main features of these four types of plant.

For all except "tunnel" or "portable floor" driers, airtight side walls should extend to within about one foot of the maximum loading depth. The platform must have adequate strength, and usually consists of welded steel concrete reinforcing, laid over 3×4-inch timber bearers spaced about 2½–4

feet apart according to loading depth, and to whether grain is to be dried. There must be a blanked-off strip round the edges of the floor—about 1½ feet wide for shallow batches and 3 feet wide for deep storage driers. A well-fitting loading door 6 feet wide is needed. All driers need a simple "water gauge" manometer leading to the plenum chamber to measure the static pressure, so that the fan is not asked to operate at a pressure higher than that for which it was designed. Fans in general must be able to work against somewhat higher resistances than in the case of loose hay driers—at least 2½ inches water gauge for deep storage and high air-speed driers.

Deep storage

Where a deep storage drier is used, loading must always depend on the condition of the lower layers. No more than six layers should be loaded at a time, and after this has been done there should be a pause until the lower ones are nearly dry. The advantage of this type of drier is that there is no double handling, but very wet bales cannot be dealt with effectively. The fan must be capable of working against at least 2½ inches water gauge, and care must be taken not to load in such a way that the fan stalls, since this can result in little or no air getting through. The fan should be kept going throughout the early stages of drying, as any spontaneous heating is likely to be uneconomic and impede subsequent drying.

Walled batch driers

The general rules for operation of walled batch driers may be summarized as follows:

The wetter the crop, the smaller the bales should be, and the smaller the loading depth. With all-electric plants, it will usually be most economic to start with cold air.

Because of lack of uniformity, drying must continue until the average moisture content is about 15 per cent. To get the best out of this type of installation one must grow a succession of suitable leys to enable drying to begin about the end of May and continue throughout the summer. This can fit in well with good pasture management on a dairy farm.

Tunnel driers

Tunnel driers are well suited to conditioning large batches of fairly dry hay. The wetter the crop, the thinner must be the layer of bales through which the air is forced. There may be a temptation to make tunnels very long, but this should be avoided. An air flow of 15 c.f.m. per bale is suitable only for fairly dry bales. A flow of 30–40 c.f.m. per bale is required if the bales are very sappy. For a stationary drier there is considerable advantage in having at the back of the barn a long brick duct with air doors at about 15 feet intervals, to enable several short tunnels to be built at right angles to the duct. This accommodates a large quantity of hay, and gives a high degree of flexibility in operation. Thus, with fairly dry hay, a single short tunnel can be built to hold about 10 tons, and in a 5-bay Dutch barn five such tunnels can be built before it is necessary to remove the first. In such a case the fan

will probably be expected to dry only two tunnels simultaneously, but when there are two tunnels partly dried and one freshly loaded it will usually be quite practicable to suspend blowing the first two for several hours at a time, while concentrating the fan's power on the newly-loaded tunnel.

The best form of tunnel and tunnel support has not yet been settled, but it seems likely at present that the ideal will be more like an unwalled drying floor than a tunnel. An advantage of the "tunnel" method of hay conditioning is that the whole of the floor space can be cleared and used for other purposes, such as the bulk storage of potatoes.

A portable drying floor can also be effectively used out in the field, a tarpaulin cover being put over the crop during operation.

Warming the air

There were occasions during the 1958 summer when the air was so cold and damp that it paid to warm it by about 5°F throughout drying, whatever the source of heat. For speedy completion of the job it always helps to use a little heat, and the only problem is an economic one. The cheaper the source, the more it pays to use it, and where oil or coke can be effectively employed, it pays to use heat to a considerable extent. One attractive method of conditioning fairly dry bales is by a portable tractor-driven or engine-driven unit which utilizes the waste heat of the engine driving the fan. It is a simple matter to cover the engine and fan in such a way that a fairly high proportion of the waste heat from the cooling and exhaust systems warms the drying air. A temperature rise of about 5°F can be obtained.

Drying costs

Accurately recorded results on a commercial farm in Buckinghamshire in 1958 showed that with an oil-fired heat-exchanger, total drying cost (electricity and oil) for over 50 tons dried averaged £2 per ton, for crops which were mostly over 55 per cent moisture content at baling. On an Experimental Husbandry Farm in Warwickshire where the scale was also a practical one, average drying cost (electricity and oil) for 38 tons dried in a medium air-speed plant with oil-fired heat exchanger was 48*s*. a ton. The comparable cost with a cold-blow/warm-blow all-electric plant on the same farm was 72*s*. a ton. Much of the hay on this farm was dried from a moisture content of 50 per cent or over, and these costs are above average.

On another Experimental Husbandry Farm in the Pennines where a coke-fired furnace was used, three large batches of good baled hay were dried in 1958 at a fuel cost of about £1 a ton. The work in the barn on the barn-dried crop was no more than the extra in the field on field-dried crops, which were of very poor quality. In better seasons, costs with many all-electric cold-blow/warm-blow installations have averaged less than £2 a ton. Even in 1958, average cost with commercial cold-air storage driers has been in the region of £1 per ton. In general, there is no reason to suppose that costs will differ much from those given in the table dealing with loose hay driers, and these include a reasonable allocation for overheads. Altogether, it seems right to conclude that there is a big future for barn hay drying in Britain.

Harvesting and Marketing Cabbage Lettuce

A. SKELTON

Ministry of Agriculture, Fisheries and Food

This article describes how most of our estimated annual production of 68,000 tons of cabbage lettuce is brought to the consumer, some of the errors that can be made, and improvements which might be more generally adopted.

OF the total quantity of summer lettuce grown in this country, three-quarters is of the cabbage type, although cos and the curly type, at present grown mainly in the north, are finding increasing popularity in the south. Commercial production is shared by growers on holdings of all sizes, and most of them plan their first sowings to hit the market around mid-May, when demand is expected to be good.

Arising out of a recent investigation carried out by the Ministry of Agriculture into, among other things, harvesting and packing procedures on about fifty holdings, the following observations will be of general interest.

Preparation for harvesting

Crates or boxes should be stood out on the headlands at both ends or sides of the patch to be harvested. On large pieces where several acres come into cut at once, rows may be 300 yards long and the area 50 or more yards wide. Here it becomes necessary to sub-divide the plot by cutting and clearing one or more narrow tracks for tractor and trailer to pull through and stack empties on either side, wherever possible making use of gaps where several plants together have been hoed out, or the existing plants obviously are not worth leaving. Where the plants are 12×12 inches apart, and often they are closer than this, it should in theory be possible to cut well over 1,500 crates of two dozen lettuce per acre, but seldom does any grower estimate production at more than 1,000—and he usually gives an average around 700. These figures show that growers do not expect to achieve anything approaching 100 per cent of the potential from a bed; and this is borne out by casual examination of almost any piece which is about ready to cut, the gaps, patches of weed and waste heads being readily discernible.

Harvesting and packing in the field

The actual cutting for market should be about the first operation of the day. In the early morning the lettuce are cool and fully turgid, whereas if they are left until the midday sun has played on them, and cut then, the

heads will quickly become limp. It should be the aim to have all the heads cut and off the field by eleven o'clock at the latest.

Cutting and packing on the field is usually done by teams of three or four, one packer working to two or three cutters. No special knife is used for this purpose, the operators providing their own, but the more efficient people use a small knife with a blade curved slightly forward at the point, like a pruning or lino cutting knife. This is convenient not only for severing the stem but also for any additional trimming of basal leaves that may be necessary. The cutter should first test the heart with the back of his hand for firmness as an indication of degree of maturity. (A finger would serve the purpose equally well, but it might very easily puncture a leaf or cause unnecessary bruising.) At the same time he should make a swift examination for quality, any showing heart rot or other progressive disease being rejected, thrown on the ground away from those put for the packer, and slashed with the knife to mark them unmistakably. Working in a straight line down the field, cutters will take three or not more than five rows at a time and place the cut heads in a continuous line on one side.

Any grading for size is done at this time. Before examining the bed, the foreman should decide whether the bulk will be packed as 24s or 18s. It will usually be the former, in which case any 18s will be placed in a separate row for the packer to collect and put in special crates. Smaller lettuce for packing as 30s do not often come in the first cut off a mature piece, but rather at the time of the final cut when the bed is being cleared. A piece is not cleared at a single cutting, but three or four cuts will be taken over a period of perhaps a fortnight.

The cutters should work down the field in pairs, placing the trimmed lettuce butt upwards in a single pile across the piece. Thus packing becomes a quick operation as the heads are transferred from the pile into the crate, the bottom layer being placed butt downwards and the top layer butt upwards. Packing 24s in two layers four by three is simple, but rather more care is needed for 18s in two layers of nine. Here the pack is not quite so solid, since the three heads across the crate are triangulated, which inevitably leaves one end with two corners empty. Salesmen who prefer to quote by dozens frequently encourage the grower to pack 18s as 24s. This is detrimental to the quality of the lettuce: twenty-four 18s can be persuaded to go into a standard lettuce crate but inevitably get crushed laterally, and they ride proud of the sides, so that when the packed crates are stacked the weight is taken not by the sides of the crates but by the lettuce themselves. Some of the modern varieties produce hearts which though excellent in quality tend to reduce demand: they are too large for the average household to eat in one day so part is put in the refrigerator until required.

Having packed a crate, the packer carries it a short distance to a convenient gap for making a pile, collects an empty crate and goes on with the work, leaving the collection of the filled crates until all packing is done. On some farms, all available labour carries off the filled crates to the headlands, but it is better for some form of flat vehicle to be pulled through a cut alley to remove a large number of crates in one operation. A horse and trolley or tractor and trailer are both very suitable, or on tractors with hydraulic lift a buck-rake provides a base adequate for carrying at least 50 at a time.

In packing sheds

Where the harvesting immediately follows the glasshouse or frame-grown crop, the packing shed will probably be equipped for packing lettuce into crates lined with paper. When paper is used for the early outdoor crop it is usual to be more economical in its use than for the tender glasshouse produce. One piece of paper should cover the base, front, and go over the top with enough to tuck in at the back. A white paper is usually considered best for this purpose, though it does show very clearly any dirt and stains from the cut butt ends of the lettuce. A few growers use coloured tissue which does quite well, and some ordinary newsprint. This should never be used; it always looks dirty and absorbs water so much that it becomes little better than pulp, and tears at the slightest movement. At the market, crates lined with newspaper invariably look unattractive, often remaining unsold when unlined packs have cleared. This practice of lining the crates is likely to continue so long as the market returns are above 4*s*. a dozen, but when receipts fall below that level it will stop.

The lettuce will be cut, trimmed, and placed butt upwards in wooden or wire trays and brought into the packing shed. Here it will be removed from the tray and placed butt upwards on a bench for washing by hose, or the full trays may be passed through a mechanical vegetable washer of the tunnel type, where controlled jets squirt down and up into the trays as they pass through. Then follows a brief period for draining; the trays are stood tilted at an angle on the floor, until the lettuce are transferred to the crates in which they are to be marketed, these having been lined with paper and stacked in readiness. Remember that each handling may cause some damage, especially to the outer leaves where it is easy to fracture the tender midrib and induce early wilting. If the heads have been cut and trimmed correctly in the field, it is still necessary to watch for those few which may be out of grade for size. An experienced packer will be quick to feel these and put them aside for packing separately under the appropriate count. The packer should not need to examine the heads for quality: that should have been done in the field at the time of cutting, only good lettuce coming into the shed. When the crate is filled, the paper is folded over the top and tucked into the opposite side, making a neat package from which most dust and dirt are excluded, yet some ventilation remains at each end.

The filled crates, now ready for market, should be stacked loosely in the shade, preferably in a cool shed. As the crated lettuce may stand in this position for some hours, the crates should be lapped over one another, to allow air to circulate round and through the stack.

Where lettuce are packed in the field, some growers run the packed crates through a vegetable washer with jets running at low pressure; others prefer to lay the packed crates on the floor and give a gentle sprinkle with a hose. In either case the crates will have to be put aside and tipped up for a short while to drain. But many producers maintain that such treatment is unnecessary and undesirable for the outdoor crop, since if the trimming has been carried out adequately in the field, no washing is required. And they say that washing, by increasing the surplus water content in the tightly-packed leaves, will promote heating and rapid development of any slimy rot which may be present. Furthermore, if the basal leaves of the top layer do

still carry excessive soil, washing may carry this down into the hearts of the bottom layer.

Marketing

As transport to market is usually by road haulage, it is important to remember that lettuce is a crop which will quickly wilt. Wind is one thing that will give rise to this condition, so steps should be taken when loading the lorries to counteract it. Where possible, crates of lettuce should be put behind a screen of less delicate produce, or the front should be protected by a tarpaulin sheet which may also go over top and sides. When a sheet is used it should not be fixed down until the journey is about to start, as the load may heat. The sheet should be removed as soon as the load arrives at the market.

Movement of lettuce from the smaller producers is mainly to comparatively local markets, but some conveniently situated for using the fast main line railway serve more distant markets. Large growers in Surrey, Sussex, and the Thames Valley send their lettuce over much longer distances, to Birmingham and Manchester, and even to Glasgow and South Wales markets, where the produce is sold on commission. But a grower may also act as his own wholesaler, selling either from premises he holds for the purpose or from his vehicle, parked on a site reserved for this use. In London, growers from as far as East Kent and West Surrey sell in this latter manner at Covent Garden, exercising a right to do so which was laid down by charter in the reign of King Charles II.

Containers

Throughout, reference to crates has meant both the standard B.S.I. type of returnable and various makes of non-returnable crate of similar dimensions. These two are ideal containers for cabbage lettuce, but they are by no means the only ones used. The ubiquitous returnable bushel and half bushel boxes are used extensively, the bushel box taking two dozen 24s with some lateral compression and sometimes three dozen of this size packed in three layers, the top layer being heart upmost. The half bushel box is a convenient package for one dozen 24s packed in two layers of six, and is especially useful when lettuce is dear and retailers hesitant of buying large quantities.

Reclaimed non-returnable apple boxes are used quite extensively in some areas but are really too small; nevertheless, they have the redeeming feature of being non-returnable. So far, cardboard has not proved satisfactory in this country, lettuce being so moist that most cardboards collapse fairly quickly.

Warble Fly Costs Money

Between now and 30th June, cattle should be inspected for swellings caused by the warble fly maggot. Run your hands over the backs of long-haired cattle. Scrub an approved derris dressing into the backs of infested animals with a stiff brush, and repeat the process monthly. Treat newly-bought infested cattle within seven days.

The Importance of Variety in Brussels Sprouts

Mr. R. G. Norman, N.A.A.S. Horticulture Advisory Officer, Worcester, reports, after hearing the views expressed by C. G. Finch, M.C., B.Sc., of the National Institute of Agricultural Botany, at Evesham recently.

IN the growing of Brussels sprouts, choice of variety is supremely important. Upon it depends season of picking, yield and quality. Seed costs are negligible in relation to total production costs. The different varieties have different characteristics and should be related to the purpose for which they are to be grown. Special varieties are available for the freezers, for prepacking, and for the various markets.

There are many characteristics to look out for. The first is colour. A dark sprout always looks better in the net and does not appear to go stale so quickly as a pale sprout. In some markets, however, pale sprouts are still acceptable or even preferred. The next desirable character is smoothness, for a really smooth sprout always looks better than a crinkled or savoyed type. Size of sprout depends on the market or other outlet. Large sprouts are suitable for northern markets. Medium are ideal for prepacking, and good, small buttons are essential for the freezers.

Stem spacing makes a difference to picking and to the amount of rotting on the stem. If sprouts are spaced very widely they are easy to pick, but there are not so many of them; if too close the bases go pale or brown and slimy, they are more difficult to detach and have to be picked very frequently. The ideal sprout should not be fixed too hard on the stem. The season of maturity depends on what the grower wants—an early district may want an early variety, whereas a farmer concentrating on farm crops may prefer late picking to follow his root harvest. Crop yield is probably the least important factor in relation to the others; 2 tons an acre of first-class sprouts which can sell are a better proposition than 6 tons which no one will buy.

Uniform quality is another desirable factor. In most varieties of sprouts there are always a few really good stems, and if every stem was as good the crop would be excellent. A good variety also has fine sprouts all the way up the stem. Some variability of leaf type within a variety does not matter to a grower so long as the sprouts are uniform. Many of the sprout varieties offered today are very old; they were included in very old seed catalogues and are still listed today. Another criticism of varieties by growers is unreliability, and this can be serious in its effect on the crop. Considerable changes in type have occurred from time to time without warning.

Cost of seed

Brussels sprout seed sold by the trade is far too cheap, due to price competition, and this means that a merchant cannot afford to devote a lot of

attention to producing seed. There are unfortunately too few growers who are prepared to pay a lot more money for the very best seed, but this is the way to get a major improvement in seed stocks.

Many new introductions are growers' selections, and nowadays there is not much true breeding done by seed merchants in Brussels sprouts. It takes at least ten years to produce a new variety, and this is not economic on the present level of seed prices. Many growers raise their own stocks; a number do it extremely well, others moderately, while some growers' stocks ought to be on the rubbish heap. The best sprouts being grown today are from really good growers' stocks, and these are better than seed merchants' stocks. Careful selection and saving of seed by a grower can cost as much as £15 per lb of seed. The seedsman has to produce in large quantities and cannot grow from selected stems. He relies on roguing a seed crop, but the close planting required to give high seed yields means that it is only possible to take out a small percentage of undesirable rogues. Fortunately, there is no serious degeneration in one multiplication, and this commercial method of seed production is satisfactory if a really good mother seed is used. Seed merchants who produce really good mother seed do grow the best seed for the trade. There are too many synonyms and varieties which are very closely alike; out of 114 different stocks on trial at Cambridge, there were only fifteen to twenty main types.

A few of the more important sprout varieties and their characteristics are as follows:

BRETFORTON TYPE	This is very dwarf and very early, with closely packed sprouts, pale in colour. It is the only variety suitable for August picking.
EVESHAM GROWERS' TYPE	Generally has blue leaves, and is fairly early maturing, the sprouts being rather pale, reasonably smooth, and moderately close on the stem.
EVESHAM SPECIAL	The name covers a multitude of sins, but there are some very nice stocks about, which make it a good general-purpose variety. The variety is tough and vigorous. The sprouts are medium/pale and with a long picking season; it gives a reasonable yield of fairly smooth sprouts.
ROUS LENCH	Is early to mid-season, fairly smooth, moderately spaced but rather pale. Since the raiser died, a number of seed merchants are offering different selections, and twenty different stocks are on trial at the N.I.A.B. this year.
CAMBRIDGE NO. 1	Is easily recognized, as most of the veins start from the bottom of the leaf. It is a good early/mid-season variety, reasonably smooth, but rather pale, and good stocks are still as good as any variety for general early work.
CAMBRIDGE NO. 5	Is taller and later than No. 1, but has a big defect in paleness. Because of this, Evesham Special is a better variety.

BEDFORDSHIRE TYPE

This type is really dark, but apart from this it has few good sprout qualities. The majority of the Bedfordshire type varieties tend to be rather rough and only the best stocks are smooth. It is very vigorous and will put up with rough treatment. It is also a very late type, and late varieties do tend to give a lower yield. Only over the last two or three years has the Bedford type become widely available from seed merchants. Provided seed merchants maintain the varieties as well as the growers who selected them, they will be valuable.

Only the best is good enough

Professor G. O. Sherrard of the University College, Dublin, has bred new varieties, of which Irish Elegance is approaching the ideal in smoothness, uniformity and spacing, although the colour is not outstanding. This is an example of a highly-bred variety which must be done really well and will not stand up to rough treatment. Another of Professor Sherrard's varieties is only in its second year of trials, but it may replace Cambridge No. 1 as an early variety, since it is more uniform, smoother and darker, with a better colour than Irish Elegance, and in the trials so far it has given heavy early yields. No early dark Bedford types are available on the market, although some growers do have early selections.

Quick-freezing types are of considerable importance, particularly in East Anglia. Cambridge Special is probably the most suitable; it was originally bred as a high quality garden sprout and has proved to be very suitable for quick freezing. This variety is of good colour and smooth, with red leaf stalks. The sprouts tend to be crowded on the base, but closer planting does spread the sprouts out along the stem much better.

Harrison's Freezer is a competitor of Cambridge Special; it is very similar, although probably not quite as smooth. Irish Glacier, bred by Professor Sherrard, is a new variety which is complementary to Cambridge Special, since it is later maturing. The sprouts are more widely spaced on the stem and yield is not so high, but they are very round, clean and firm. Some Dutch varieties are also being used for freezing purposes.

To summarize, growers could not do better than plant the best Bedford types for a dark, late maincrop, a good stock of Evesham Special for maincrop—or Irish Elegance in 1960 when seed will be available, Bretforton types for very early cropping, and Cambridge No. 1 for early/mid-season crops.

Certification of Brussels sprout seed applies only to varieties raised at official plant breeding stations—the Cambridge and Irish varieties. Seed of these varieties grown by merchants under supervision is issued with a certificate, and growers who want to use these varieties should always insist on certified seed. Just because seed is certified it does not necessarily mean that the variety is the best for any particular grower, but it does ensure that plants will be true to type.

Straw Poultry-houses

JOHN L. JONES

A UNIQUE system of housing layers on deep litter has been worked out in practice by Mr. F. H. Gale, the General Manager of English Farms Ltd., in Wiltshire. Fully-furnished accommodation for 5,000 layers has been provided for an all-in cost of 10*s.* a bird, in houses 204 feet long by 20 wide, fronted with yards 50 feet deep, providing 2 sq. feet a bird inside and 5 sq. feet outside. The cost includes labour, and a flock laying average of 80 per cent lay is being obtained.

The houses are permanent but they are built of straw. The walls are made of barley straw panels, 4 inches thick and packed between wire netting on wooden frames, which rest upon a wooden wall-plate set in turn on a low concrete wall. These panels are laid between uprights in 12-feet bays, seventeen bays to the house, with an asbestos roof carrying a small pitch from north to south, and with one plastic sheet for light to each bay. There is a gap between eaves and wall of 12 inches on one side and 6 inches on the other for cross-ventilation. The straw in the panels is stitched together with binder twine, and sprayed periodically with a preservative and pest-killing mixture of paraffin and creosote.

The birds—Rhode/Sussex, Sussex/Rhode, Leghorn/Rhode—are bought in lots of 1,000 as day-old chicks, reared in field huts on good range, and brought in at five months to 10 inches of barley straw litter laid on graded chalk. Hanging hoppers are supplied with home-mixed concentrate from an overhead railway passing through the doors which divide the four subsections. These doors are hinged to open and close automatically. The railway takes the eggs on the return journey. Laying is in 24 communal nest-boxes sited some distance away from the popholes, so that the birds clean their feet on the litter.

The only straw which has to be replaced periodically forms the bales on which the outside hard panels rest. Kept sprayed, the walls should have an indefinitely long life. The heaviest rain dries off in ten minutes, as the air passes readily through the panels.

This type of construction obviously works best on well-drained ground such as the Wiltshire chalk, and is ideal where straw is plentiful. A fully-furnished building for 2,000 birds cost £1,085 including labour, and used roughly 4 tons of barley straw, counting that for the yard. The concrete blocks were made on the farm. The building is depreciated at 15 per cent a year, and obvious, commonsense precautions against fire are taken.

The photographs opposite show (1) the yards, with their walls of straw panels resting on concrete; (2) the inside of one of the houses; (3) a hanging hopper pushing open one of the pairs of doors which divide each house into four parts. Spring-loaded hinges close the doors automatically; and (4) a pophole, set high to reduce draughts at hen level. A bale of straw helps the birds in and out.

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The Future of British Potato Farming as I See it (Article on pp. 9–13)

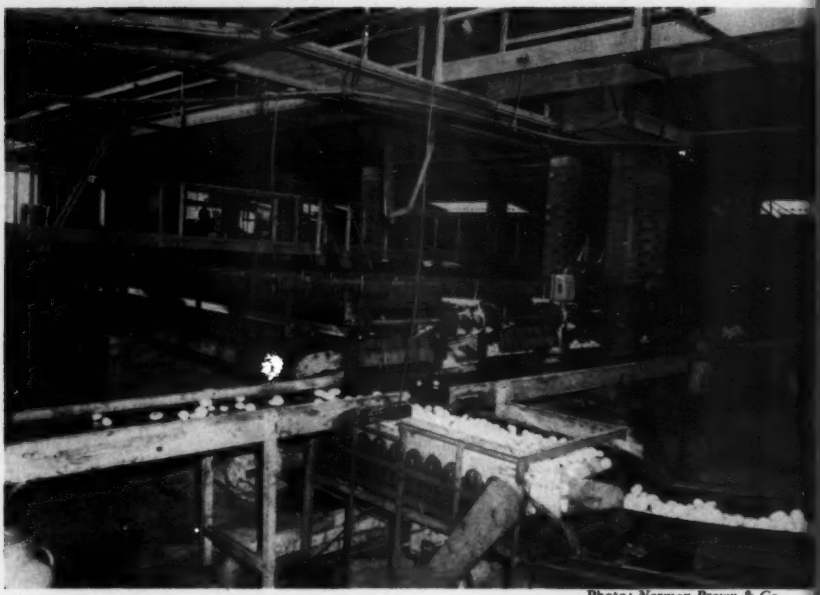


Photo: *Norman Brown & Co.*

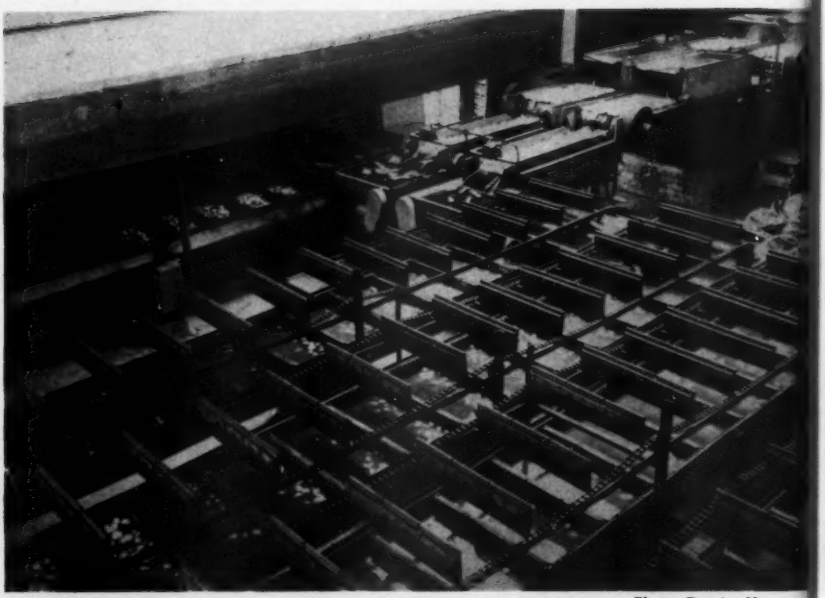


Photo: *Farming News*

The Castleton potato-washing plant.

Broken Mouth in Hill Sheep (Article on pp. 5–8)

Lambs with sow mouth would be drafted out.

Type 1 occlusion should be selected for breeding in hill flocks.

Broken mouth and parodontal disease are more likely to occur in hill sheep with type 2 occlusion.

Photos: *Dundee Dental School*

Sheep with type 3 occlusion cannot crop short grass.

Belvoir (Article on pp. 27–30)

Photo: *Mustograph*

The present castle was built in the nineteenth century on the Mound . . .

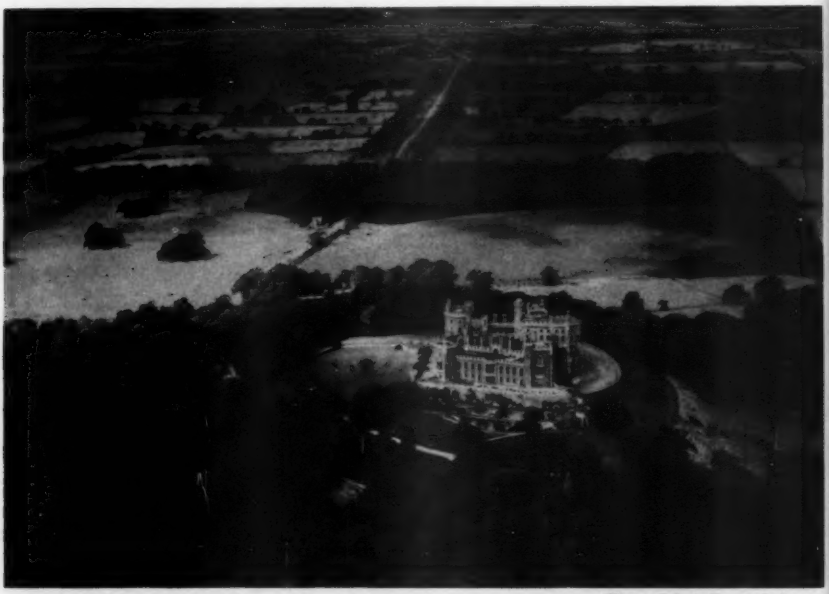


Photo: *Belvoir Estates Ltd.*

. . . some 300 feet above the flat claylands of the Vale of Belvoir. The avenue leads to Redmile and on to Nottingham.

Belvoir

L. M. PARSONS
Agricultural Land Service, Nottingham

Blest place, that on the confines stands
of the two Kingdoms, Earth and Heaven
in doubt to who the just right should be given

LEICESTERSHIRE cannot boast of many great county seats. Belvoir, home of the 10th Duke of Rutland, is one of them; and surely few in Britain can stir the imagination so much as this castle set on the Mound of Belvoir, some 300 feet above the flat claylands of the Vale. To the south-west lies the rolling wold country north of the Wreake Valley.

The fine Belvoir escarpment, also known as the Melton Ridge, runs for 14 miles north east from Six Hills on the Fosse Way to Belvoir and Knipton village. On the top of the escarpment the marlstone gives rise to fertile redland running the length of the "heath", a light free-working soil in marked contrast to the deep Lias clay pastures of the Vale. This redland is and has been extensively worked for ironstone. On the slopes and in the Vale, the Lias clays have produced a heavy, deep loam which carries famous luxuriant neutral pastures—the heaven of hunting men the world over.

The property of Belvoir Estates Ltd. stretches from the strong loams and clays of the Vale, over the scarp top to the fertile red marlstone of the heath. Once extending to over 60,000 acres, the estate now consists of 16,000 acres roughly equally divided between Vale and heath. There are 1,500 acres of woodland clothing the scarp slope. Extensive sales between the wars have reduced the estate to its present size, but most of these sales have retained the mineral rights. Considerable mineral reserves still exist, although much has been worked and some workings are being carried out almost on the edge of the Park.

Very few of the farms are over 400 acres; the majority are considerably less. Nearly all the farmhouses are in the villages, and their land is greatly fragmented, with no apparent design. Some have enormous sets of buildings running with a small acreage—others are sadly lacking in accommodation for their much larger farms.

The agent, Mr. John F. Croome, in conjunction with his directors, has a policy designed to achieve properly equipped ring-fenced units of suitable size. Farms of less than 100 acres have to justify their existence completely. The fulfilment of this policy must, of necessity, be a long and arduous task, as farm boundary readjustments can generally be made only when tenancies end. There have been very few changes of farm tenancy in the past ten years. The relatively high age-group of the present tenants promises more chance to rationalize farm layout in the 1960s.

Hereditary tenancies

One of the drawbacks of an ancient hereditary estate is well illustrated in this matter. Farm tenancies have passed from father to son until hereditary

tenancies have become almost customary. Similarly, the rents charged have remained low, with the consequent cramping of improvement work. A policy of revival has been hindered still further by old agreements and by the unsatisfactory distribution of obligations between landlord and tenant that has come to be accepted. It is a difficult task to alter these various results of the long association of farm families with the estate.

The fragmentation of holdings could be connected with the enclosure movements of the late eighteenth century, when the open fields of the Vale, formerly under the plough, were turned over to grassland, and the heath on the hill, once used as a sheep-walk, became the arable land of the district. Platten, writing in 1639, described the open fields of the Vale optimistically as the best cornland in Europe, and this has undoubtedly been reflected in the much later well-known excellence of the pastures. But the long hereditary tenancies and consequent lack of diversified farming experience have not helped to secure a full understanding of modern grassland management; and this has been aggravated by the depressed rents of the past 150 years. For various excellent reasons of sentiment and personal attachment, there has in the past been a reluctance to fix rents at a level high enough to encourage farming worthy of such an estate. In the early 1800s the average rents were 18*s.* per acre; by 1947 they had only risen to 20*s.*, and today the average is 30*s.* But a revision of all rents by an outside expert is proceeding under the new policy. This will take into account the outworn customs of the estate—such as affect drainage and fences for example, both of which are basic requirements for proper economic farming in the grassland Vale.

New farming for old

In this connection it is worthy of note that the Home Farm of some 1,200 acres has more than played its part in rehabilitating the farming on the estate. In 1947, when it was half its present size, there was very little mechanization. Most of the implements were horse-drawn—indeed 37 working and other horses lived on the farm, giving service not only to the Home Farm, but to the whole estate.

The running of this enterprise was hardly in accordance with modern ideas, and steps were taken to reorganize and re-equip it, gradually taking in more land and reclaiming large areas of the Park. Today, the Home Farm is a highly mechanized unit, heavily cropped and stocked and playing a valuable part for comparison purposes on the estate as a whole. Any more land taken in hand will be used to form a second unit, as Mr. Croome believes 1,200 acres to be adequate for one. Odd parcels falling in are often attached to the nearest holding, the temptation to farm them in hand being resisted unless it would be practical and economic to do so. Fourteen permanent staff are kept, but much of the farm work is carried out by seasonal gang labour, thus reducing administration and supervision costs to a minimum. The estate itself has given a valuable lead in showing the place of contract labour in modern farming, a lead which many smaller farmers could well follow.

Casual labour for forestry is rather difficult; to assist in getting it, the estate and some of the local farmers have formed a small company to own and run a hostel at Stathern where members can house their men.

The only other very large farm on the estate is run by the Belvoir Grass Drying Company, directed by the Duke and his brother, Lord John Manners. As evidence of further enterprise, some thousands of Beltsville White turkeys are reared every year on this farm, an expanding and well-known business based on an original importation of foundation stock by Lord John from the United States. The birds are kept outside all the year from an early age and present an unusual spectacle in the depths of the Belvoir countryside.

None of the purely trading concerns of the estate is allowed the privilege of subsidy. If they fall in profitability they are ruthlessly pruned or reorganized. The estate owns a number of villages and one of the pressing problems is the maintenance of so many houses and cottages. Most of these are occupied by tenants who are getting on in years, a survival of estate employee occupancies handed down in families. The policy, except in the villages of Knipton and Woolsthorpe, is to sell a number of these properties as they become available. The problems and costs of maintenance have been realistically tackled. There was once an estate yard, but this has been closed and only six maintenance men are now employed for urgent repairs and emergencies. Except for the modernizing of the milking accommodation on the several farms, which is done more cheaply by the estate staff, all the property maintenance and repair work is put out to contract.

To reduce the maintenance of farm buildings to a minimum, new buildings are as far as possible constructed with concrete frames and asbestos sheeting; corrugated iron is not used, partly for amenity reasons and partly because of the high maintenance costs.

The woodlands of Belvoir

The Duke takes a keen personal interest in the woodlands of Belvoir. Most of the mixed woodlands of the scarp were planted in the eighteenth century "promising for timber and fox covers, for rural amusement and exercise and a great ornament to the County". Today, the woods are all dedicated, and some 25 acres are planted annually with mixtures carefully chosen for both amenity and profit.

The forest nursery, felling and conversion are all the responsibility of a staff of twenty-five men supervised by a qualified forester. Because of expanding enterprise, this number could well be increased. The old sawmill was closed five years ago as being quite out of date, and a new, small electrically-operated sawmill put in. Both mill and forestry are strictly accounted, and the mill alone deals with £800 worth of saleable material every month. The best timber on the estate is sold by tender, and only the poorer qualities are utilized by the estate mill. The opportunities for education are not missed, for the customer can make his own choice from a selection of fencing types neatly erected outside the mill, where their relative merits can be demonstrated.

As to the woods themselves, those who have the time and energy should walk through the whole length of their rich and ever-changing beauty, for there is very little woodland in the county as a whole, although it is well provided with hedgerow timber. The magnificent sweet chestnut avenue near the Mausoleum is a joy to see, and so is Young Oaks Wood at Woolsthorpe with its fine stand of oaks.

The gardens are run on strictly commercial lines for flower and vegetable growing. Chrysanthemums and sweet peas have taken the place of peaches and vines in the glasshouses. The upper gardens of the Castle are, of course, maintained for pleasure.

Belvoir Castle

There have been castles on Belvoir Mound since 1066, and two of them have been destroyed; the present castle was built in the nineteenth century. Purely architecturally it is a disappointing mixture of styles, with its french windows in pseudo-baronial walls and its Victorian Gothic interior. But, seen across the valley from Denton or crowning the glorious trees of the long straight avenue from Redmile, this in no way detracts from its majestic serenity.

The interior splendour and treasures of the Castle must remain to be visited by the reader. The organization of visiting days is the full-time work of one man, and since over 70,000 people visit the Castle every year the arrangements for car parking, teas and so on is a small business on its own.

There are many points of interest to be seen outside the Castle itself, not least the remarkable panoramic view from the forecourt. It is said that King James I, looking over the Vale, was moved to say of his host "God, what a traitor the man would make", but it is a thrilling experience to look north-eastwards and see the sunlight caught on the leaden roofs of Lincoln Cathedral twenty-six miles away. Truly may one say with the anonymous poet,

from hence the sweetest prospect lies
That e'er entangled wand'ring eyes.

Here are trees, pastureland, towers and spires, the tallest and celebrated spire at Bottesford, crocketed to the top, sheltering the stately monuments to the Earls of Rutland, and everywhere the lordly peacock of the Manners. But fifteen miles away tall chimneys and a blue haze show where Nottingham adds its quota to growing industrialization.

Below the Castle lie the villages of Knipton in Leicestershire and Woolsthorpe in Lincolnshire, delightful stone villages, each with its lakes and fishponds linked by the Devon River and adding much to the beauty of the landscape. The Hunt Kennels lie in Knipton Pasture under the Castle hill and are justly famous, for the Belvoir tan is celebrated the world over.

Crossing the Castle drive is the oldest example in the world of the iron rail, constructed by the Butterley Company of Ripley, designed to carry Jessop's new flanged wheels. This is part of a single track railway constructed in 1793 for carrying coal from the Grantham Canal, where it was brought by the Duke's private barges from the coalfields of Nottingham and on to the Castle by horse and tramcar. Today the Castle is centrally heated by oil.

With its background and the traditions and customs inherent in such an ancient estate, Belvoir typifies the immense problem of reconciling the past with modern techniques and economic attitudes. It does more—it presents a salutarily energetic approach to that problem.

A Case for Yard-and-Parlour

Building Alterations on a University Farm

W. BROWN, B.SC., M.S., N.D.A., N.D.D.

University College of North Wales, Bangor

New dairy buildings on the yard-and-parlour system are enabling the University College of Wales farm at Bangor to produce more milk more cheaply and with fewer men. The old cowsheds will be used for other enterprises.

THE problem before us at the University College farm was whether to adapt the existing cowsheds, which provided accommodation for about sixty cows, and just build a new dairy, or to scrap the dairy premises entirely and start afresh. The cowsheds were of stone, and their adaptation would have cost a lot of money, and resulted in a set of dairy buildings which still did not allow efficient use of labour and other resources. Another equally important reason for deciding on new buildings was that since the farm is used for demonstration purposes, it was essential to provide buildings of the most modern design. Also the old dairy could be released for the development of other enterprises, for example pigs and poultry, which are essential on such a farm. The enterprises for pigs and poultry were on a very small scale before the new dairy was built.

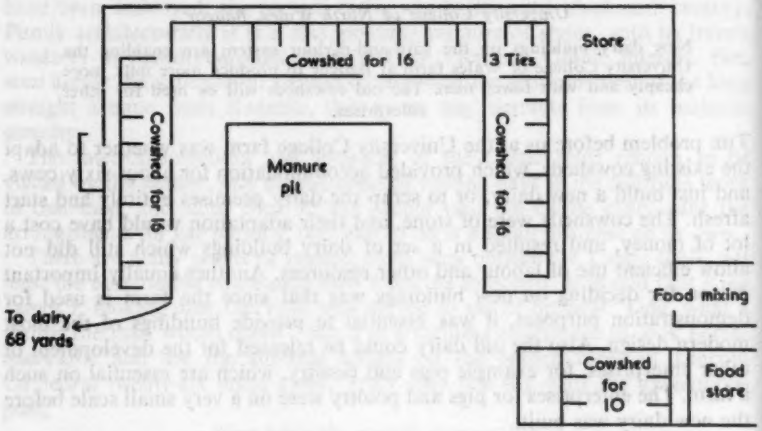
Existing cowsheds

Cowsheds housing some fifty cows occupied three sides of a square, with a fourth cowshed near by housing another ten animals. Milking was done as efficiently as possible under the circumstances, with two men operating six units. A third man had to carry the milk to the dairy, and helped to wash udders in advance of the milkers (a system which recent studies have shown to be rather inefficient). Milking under this procedure was most laborious: the men had to walk to and fro outside the buildings because there was no direct access from one cowshed to the other. The outcome was that some cows had the units on much too long, and there was not time for individual attention. Feeding concentrates presented no problem, because each cow's ration for the day was weighed into a bucket which was available in the feeding passage. All the animals were fed before milking actually started. Transferring milk to the dairy took up most of the time, and even though a trolley and ten-gallon churns were used, it was estimated that the man doing it walked some 700 miles a year—as far as from Oxford to Glasgow and back! Before milking began, all the equipment had to be taken from the dairy to the cowshed, and afterwards returned to the dairy for washing up. The scattered nature of the buildings (caused by additions made from time to time in the past) made this a poor use of labour and an inefficient milking routine. This particular disadvantage is applicable to one set of buildings, and in no way is it a reflection on the cowshed method of milking cows.

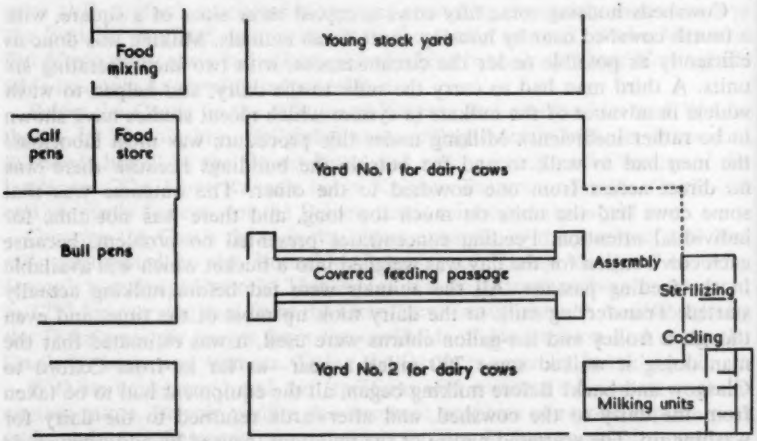
Yard-and-parlour system

The erection of a yard-and-parlour system in North Wales, where a grass type of farming predominates, may be criticized. However, it was felt that the difficulties it presented were not insurmountable, and that this was the

The original cowsheds . . .



. . . and the yard-and-parlour layout which replaced them



best building design to adopt. There seemed little difference between the costs of erecting a traditional cowshed and a yard-and-parlour system.

The layout of the new buildings, which are of a standard design, provides accommodation for 60 cows in two yards, with an adjoining abreast type

8-stall, 4-unit, in-churn milking parlour operated by two men. The milking machine operates on a 3:1 pulsation ratio.

In-churn milking has many assets to commend it, not the least of which is the small amount of equipment to wash up. The equipment provided by most manufacturers today does not normally make provision for milk filters to be used. From the legal standpoint, filters are not essential; in fact, it has been pointed out that they are very bad, since they remove only visible dirt and may conceal the fact that the milk has been produced under unhygienic conditions. Whether filters are present or not, the udders must be effectively washed. Udders may be dirtier when cows are housed loose, so that washing entails more work. No matter how effective the washing, the presence or absence of hairs in the milk can be controlled only by filters, even if the udders are regularly clipped. Hairs may be a source of contamination, but the main point to emphasize is that filters should not be used to hide slip-shod methods in milk production.

The cows are rationed with concentrates in the parlour, but are given a maximum of 6 lb only, which can be eaten during milking. Any high-yielding cows requiring more concentrates than this are grouped in one yard, where they receive the balance due to them. Yokes are fitted to the mangers in the yards to ration this extra food. It may be argued that no concentrates should be fed in the parlour at all when they can be fed in the yards, but in this particular case there are two points in favour of parlour feeding. Firstly, since the mangers are not fitted with divisions, not all the concentrates could be rationed accurately, and secondly, since each man in the parlour has only two units to manage, the feeding of concentrates does not reduce labour efficiency in the parlour (as it stands at present). It should be mentioned that economic yields, and not expensive high yields, are the aim on the College farm.

The milk is taken from the parlour to the cooling room, where it is placed on an ice-bank in-churn cooler. This method of cooling may be expensive to instal, but it has many advantages. There is little equipment to wash up, and where water is scarce such an arrangement is commendable. Cooling is efficient because it is quick (reducing the milk from blood temperature to 45°F in 12 minutes), and the milk is exposed to the minimum of contamination.

The equipment is washed by traditional methods. Quaternary ammonium compounds are used in the washing-up water, so that after suitable rinsing with clean, hot water no further treatment should be necessary. This method has proved effective on the farm so far as milk souring and other harmful bacteria are concerned, but the equipment is also steam sterilized to ensure its absolute cleanliness.

Two systems compared

The basic difference between keeping cows in cowsheds and in yards is the freedom which the cows enjoy. No trouble from damaged teats is experienced. Bully cows may be a disadvantage, but this difficulty can be overcome as far as feeding is concerned by using yokes on the mangers. Yokes actually become a necessity when any form of rationing is carried out in yards. The main fault in using yards in a non-arable area is the need for

straw. On a farm like ours, where only 48 acres of cereals are grown, the buying-in of straw is a serious limiting factor. When cows are yarded completely during the winter without self-fed silage or an open exercise yard, they will need approximately one ton of straw per cow for the season. Bought straw can be justified only if saving can be made elsewhere, and this has been the aim on our farm. An incidental but important factor is the increased amount of good quality farmyard manure which becomes available for the land when straw is bought.

The straw requirement is aggravated in this particular set of buildings because a greater area per cow is available than is necessary. The minimum recommended per cow is 100 sq. feet, although even this may be high in some cases, but in these buildings 114 sq. feet are available. This is because the installation of yokes on the mangers limits the capacity of the yards to thirty cows each. If silage was self-fed (and it is hoped that it will be very soon) it might not be necessary to ration concentrates in the yards. More cows could then be housed, thereby spreading the cost of the straw and other overheads over a greater output of milk.

It is important under such a system that the yards should be filled only with milking cows, because not only do dry cows occupy valuable space, but they also reduce the number of cows passing through the parlour. Accommodation for the dry cows has been found by adapting another building and using the equipment in the original cowsheds.

The number of men required to provide labour for milking has been reduced by one. In this particular case the timely retirement of one man has allowed the labour complement of the farm to be directly reduced. The two men working the parlour have a much easier job to do. As well as there being an overall improvement in the efficiency in the use of labour, there is less walking. All the equipment the men require is at hand, and more time is available for individual attention to the cows.

Some studies have been made to compare the two systems. Although only of a preliminary nature, they have revealed some striking differences.

A comparison of cowshed and yard-and-parlour milking methods

	Cowshed	Yard-and-parlour
Average number of cows milked per milking	50	60
Men employed	3	2
Milking time per cow* (*min.*)	9	5
Throughput (cows per man-hour)	10	26

* "Machine on" time

The improvement in milking time per cow is due largely but not entirely to improved methods. The slowest milking cows, which in some cases were the highest yielders, were culled because they were causing too many delays in the parlour. The increase in throughput of cows per man-hour is striking, because one man less is employed during milking. Even the figure quoted here may in time be improved upon.

The advantages of the yard-and-parlour system appear too many to dismiss lightly, especially in this particular case. It is certain that benefits are going to be seen in the long run, since milk can be produced more cheaply than under the cowshed system formerly in use.

The First Agricultural Survey

NIGEL HARVEY

In 1603 Bacon proudly wrote: "It is my intention to make the circuit of knowledge, noticing what parts lie waste and uncultivated, with a view to engage the energies of private and public persons in their improvement." Sixty years later, the Royal Society, continuing this tradition, undertook the first agricultural survey in our history, planning to use the information thus obtained as a basis for agricultural improvement. They failed, but their work was prophetic.

IN the middle of the seventeenth century, in the days of Charles II, a new figure appeared on the agricultural landscape. He was not particularly important or influential, indeed his achievements were negligible, and few farmers of the time even knew of his existence. But the future was with him. His descendants were to revolutionize crops and stock, equipment and methods and the whole concept of farming. For this new figure was the man we now call the agricultural scientist.

In those days, however, he was not an agricultural scientist. Indeed, by modern definition he was often not a scientist at all. Sometimes he was a general investigator who happened to spend some of his time on agricultural matters, sometimes he was a layman who spent some of his time on scientific investigation and chose to interest himself in farming. For it was long before the development of science made necessary the specialization which we today take for granted. The men of the 1660s continued the sanguine tradition of Bacon who, in the midst of a busy public life, planned a new scientific system and boasted, not wholly unjustifiably, that he took all knowledge as his province. Wren, whose genius was applied to mathematics, astronomy and anatomy as well as to architecture, was typical of his age. It was natural that men with minds so vigorous and versatile should concern themselves with farming, the trade by which most of their fellow-countrymen lived. It was equally natural that there was little specifically agricultural about the small group which the Royal Society, the proud new centre of scientific learning, deputed to study agriculture and agricultural needs.

Georgical Committee

At first sight the "Georgical Committee" of thirty-two members established by the Royal Society in 1664 resembled a peculiarly representative brains trust rather than a serious agency of agricultural improvement. It included such stimulating but apparently irrelevant individuals as Sir Thomas Not, who had served on the personal staff of Charles I throughout the Civil War; John Wilkins, best remembered today as the intellectual father of science fiction; John Evelyn the diarist; John Aubrey the antiquarian, whose *Brief Lives* is still the envy and despair of all good gossip-columnists; Sir William Petty, doctor, inventor, surveyor and economist; Robert Boyle, the greatest chemist of his age; and Henry Oldenburg, the friend of Milton and

correspondent of Spinoza. But first appearances were deceptive. In those days few men lived far from the land, and the group mustered considerable agricultural knowledge as well as outstanding general ability.

Some members of the committee were country gentry, familiar from their youth with the routines of farm and estate. Boyle, for example, was a landowner who grew potatoes experimentally on his home farm. Others possessed some particular qualification for their task. Thus John Houghton was the first agricultural journalist in our history, Sir William Petty had prepared schemes for the large-scale redistribution of farmland in Ireland, and John Beale had written a book on the orchards of Herefordshire. More generally, half of the committee had already shown their interest in agriculture by serving on another body which the Society appointed two years before, to examine the possibilities of potatoes as a general crop. It was a keen as well as a strong committee.

Unprecedented aim and methods

It was also a scientific one and its policy foreshadowed the scientific age; for it proposed to do something new and to do it in a new way—to make a systematic and dispassionate survey of the state of English agriculture and use the findings as a basis for planned improvement. The first purpose of the completed report, "to make known what is known and done already, to enrich every place with the aids that are found in one place", was an old idea—at least as old as the medieval writers who prepared their treatises for the progressive landlords of their time. But "the consideration of what further improvements may be made in all the practice of husbandry" was a new and startling departure. Men had made agricultural improvements before this, but locally, personally and piecemeal. This was the first time that a body of detached men had studied the general needs of the farming industry, to bring to its assistance the promising new power of experimental science.

The aim of the Georgical Committee, therefore, was unprecedented. So were its means, for it devised the first agricultural form ever to reach the countryman. These "heads of enquiries" made a substantial document of twenty-five questions, seeking information on types of soil, manuring, marling, fallowing, cultivations, rotations of crops and varieties of crops grown, on yields and methods of threshing, on types of grass and methods of haymaking. It was a detailed and purposeful catechism which showed clearly the grasp of the committee which prepared it. It also illustrated in a very interesting way the system and assumptions of the time.

Firstly, there was the emphasis on arable farming—nineteen questions on arable to six on meadows. The main purpose of agriculture was still the production of daily bread and, though recent researches have shown that in some areas grass was grown as a crop as early as the sixteenth century, the farmer had as yet learned little about the improvement of grassland. Secondly, there was a painful preoccupation with the industrial hazards of corn-growing. Four of the nineteen questions on arable farming dealt with such "common accidents, diseases and annoyances" of growing, stacked or threshed grain as "mildew, blasting and smut", "weeds, worms, flies, birds, mice, moles, etc." and "mice, heating and rain". Thirdly, there was clear evidence of interest in reclaiming the less promising types of land. Popula-

tion, particularly urban population, was increasing and the ancient woodlands which commonly covered the better soils were dwindling. More and more farmland, therefore, was being won from the poorer areas of the waste, from coastal marsh or inland fen. Significantly, one question asks about the ways of "reducing heathy grounds into profitable lands", another about the best methods of "draining marshes, bogs, fens, etc.".

Only twelve forms returned

By 1665 the forms were ready, and various members had made themselves responsible for obtaining reports from their home districts. But only a dozen returns were collected, some from Dorset, Gloucestershire and the West Country, some from Yorkshire, some from Kent. From elsewhere, nothing. The scheme failed, leaving as legacy only a bundle of papers which lay forgotten in the Society's archives until they were discovered by Lennard in 1932.

At first sight, therefore, the only historical importance of this curious episode lies in the information given by the dozen returns that were collected. Of course, such a sample is far too small and biased to justify any generalizations about so varied an industry as Stuart farming and, in any case, most of the answers describe practices too detailed and local to concern anybody but the specialist student of particular areas or particular techniques. Even so, the collected reports tell us many things that are interesting, and some that are surprising. On the one hand, ploughing by horse is mentioned more frequently than ploughing by oxen; rotations were more varied and more productive than we should expect from the standard accounts of the three-field shift; and in the West Country, at least, purchased clover seed was commonly used for sowing down leys. On the other, two-field husbandry, "where they sow their land but every other year", survived in the Gloucestershire uplands, and the even older infield-outfield system in the Yorkshire Wolds. Past and future mingled in Stuart farming as in Stuart England.

Success out of failure

Nevertheless, the true importance of the work of the Georgical Committee does not lie in the information it produced. It lies, paradoxically, in its failure to produce more information, in its failure to complete the task it had set itself; or, more accurately, in the causes of this failure. For it is an error to assess history solely in terms of "what actually happened". The character of an age is sometimes best revealed by the things which failed to happen, and here the point is crucial. Some of the best minds in one of the most intellectually brilliant ages of our history went to a great deal of trouble to prepare a scheme for collecting certain information for certain purposes; and they abandoned it long before they were even in sight of their goal. Why?

There was, of course, the great plague of 1666 and the disorganization which it caused. But this surely should only have caused delay, not abandonment; the men of the time took a stern line with natural calamities, to which they were only too accustomed. Then there was the difficulty of obtaining replies—the last mention of the scheme in the Society's files was a plea in February 1668 that "those members who had engaged formerly to procure

accounts from other parts of England should discharge themselves of their several obligations". Admittedly, nobody likes filling in forms and most people can find good reasons for postponing doing so. But any squire could have answered the twenty-five questions without leaving his fireside and, if letters proved an ineffective method of extracting information, the men of the Royal Society would have found merely physical difficulty in visiting the requisite number of manor-houses. No, plague and the lack of response are not sufficient explanations. The cause of failure must surely have been internal, and it is a reasonable guess that the committee lost heart because they saw the difficulties were too great for them. Their purpose was sound, but even limited experience must have showed them that their tools were pitifully inadequate for the job they had undertaken.

They could, no doubt, have completed their survey and prepared from it a list of agricultural needs, but they could not have done much more. They had pathetically little to offer the farmer, for their knowledge and inventions lagged far behind their eager curiosity. What had Aubrey or even Boyle to say to the farmer at the plough's tail? And in any case they could not present their findings in terms acceptable to the ordinary countryman. They could, for example, show him potatoes. They could tell him how to grow them. But they could not take him to see successful crops of potatoes grown under the conditions of his own parish, neither could they help him re-plan his rotations to incorporate the new crop.

More generally, the times were not with them. In the seventeenth century, the traditional farming system could still meet the demands of the nation. There was no driving necessity for drastic improvement. That was to come in the next century, when the factory system had called into existence the huge and hungry markets of the industrial towns. Behind Bakewell and Coke lay Birmingham, Manchester and the Potteries, behind the enclosures lay bread riots. But there were no such incentives in the England of Charles II. The Georgical Committee were preparing a response to a challenge which had not yet arisen.

Beginning of a new age

So they failed. Indeed, we moderns, endowed with that ripe wisdom which comes after the event, can see clearly enough that they could not possibly have succeeded. But we can also see something else. We can see a new and revolutionary force entering the agricultural world; we can see the beginning of a new age. For until the seventeenth century, agricultural knowledge was the product of the farm, a code of local lore developed by generations of local experience. The farm answered the questions that the farm raised. The ploughman taught the ploughboy, father taught son, farm work taught farm practice. But now, for the first time, men who were not farmers were making a general effort to bring to the farm technical resources which had not been evolved there. They had little to bring and no effective methods of bringing it. But they tried, they tried in the right way, and their efforts were prophetic. Behind Boyle, Petty and Houghton we can see the agricultural chemist, the agricultural economist and the agricultural educationist of today; behind the committee as a whole we can see, more dimly, the research and advisory services of the modern age. Yet between these pioneers and the agricultural

system we see around us there is no continuity. They failed, their work was forgotten, and those who eventually succeeded to their task knew nothing of their efforts.

In a sense, therefore, the records they left are no more than fossils, interesting but irrelevant relics of lines of development which perished. But if we are wise we will follow the error of the ancients who saw in fossils the first crude and unsuccessful attempts at creation by the pervading and tireless life-force which later made the world they knew.

THE MINISTRY'S PUBLICATIONS

Since the list printed in the March 1959 issue of AGRICULTURE (p. 642), the undermentioned publications have been issued. Advices of new and revised literature issued by the Ministry of Agriculture, Fisheries and Food will in future be given each month instead of quarterly.

MAJOR PUBLICATIONS

Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.

BULLETINS

No. 168. Table Chickens (*New February 1959*) 4*s.* 6*d.* (4*s.* 11*d.* by post)
Deals with the large-scale production of table poultry, particularly broilers and poussins, but also roasting and boiling fowl and capons. Stock selection, feeding, hygiene, killing, processing and marketing are all fully described.

No. 169. Diseases of Cattle (*New January 1959*) 4*s.* 6*d.* (4*s.* 11*d.* by post)
This bulletin is divided into sections dealing with infectious disease, breeding troubles, parasites, animal deficiencies and excesses, and metabolic disorders. Detailed descriptions of the cause, symptoms and methods of control of each disease or disorder are given, and a list of notifiable diseases is included.

Technical Bulletin No. 8. Biological Methods for the Evaluation of Rodenticides (*New November 1958*) 3*s.* (3*s.* 4*d.* by post). (This was wrongly shown last month as Evaluation of Insecticides.)

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3*d. each* (5*d. by post*).

ADVISORY LEAFLETS

No. 110. Frit Fly (*Revised February 1959*)
No. 225. Cutworms (*Revised February 1959*)
No. 274. Wart Disease of Potatoes (*Revised February 1959*)
No. 321. Eyespot of Wheat and Barley (*Revised February 1959*)

Farming Cameo: Series 2

13. Repton, Derbyshire

GRAHAM ROSS, B.A., DIP.AGRIC.(CANTAB.)

District Advisory Officer

THE N.A.A.S. district which takes its name from Repton lies between the Derby-Ashbourne Road in the north and the River Dove to the west and south-west; from the confluence of the Dove and the Trent it extends further south, as far as the River Mease from Croxall to Netherseal. Its eastern limit is the Derbyshire/Leicester border from there to Melbourne, and thence the road to Derby. The Trent almost bisects the area from west to east, and at Swarkestone it was the most southerly point reached by Bonnie Prince Charlie and his army in 1745. In the west the district is devoid of industry; it is completely rural and peaceful. But on the eastern border with Leicester the country is ravaged by coal-mining, both opencast and deep mine, and by clay workings. The town of Repton itself, built on the site of a Saxon settlement, was once the capital of the kingdom of Mercia, and for 400 years has been the home of a famous public school.

The soil types of the area vary considerably. There are wide bands of light alluvial soil in the valleys of the Dove and Trent, and a band of Keuper Marl stretching from Doveridge in the west, north of the Trent, right through the district; parts of Repton, Foremarke and Ingleby parishes are on an outcrop of Bunter Sand, and there are Coal Measures along the Leicester border from Netherseal to Melbourne. A soil type which is uncommon and unexpected is the black fen soil found on the Derby Borough border in the parishes of Sinfin and Sinfin Moor, Sinfin being a corruption of Syn-fen. This area of about 700 acres is served by the only internal Drainage Board in the county, established in 1837. There are about thirty rate-payers, not all farmers or landowners, but including some industrial bodies, such as British Railways and Rolls Royce.

In discussing the type of farm to be found in the area, soil types are quite irrelevant, for such is the strong tradition of dairying here that hardly any farm in the district is without a dairy herd. The parishes in the extreme west, Doveridge and Sudbury, are noted locally for their grassland, both on the Dove meadows and on the Keuper Marl, and it is here that we find the greatest intensity of stocking in the whole county. Associated with it is a reluctance on the part of some farmers to plough and grow cash crops, even though this has been shown to be a profitable alternative. As one moves from the confluence of the Dove and Trent, the river meadows found in a band a mile to two miles wide are often far from the farms, many having become completely separated; consequently they are often used as dealers' land. The traditional attitude to grass dies hard in this part of the county, but now many dairy farmers are improving the management of their grass and relying more on silage and the use of electric fences. This means that the

acreage of traditional root crops is declining and more land is available for cash cropping, so that the acreage of wheat has risen on some farms in the last few years. At the present time, fertilizer usage in this area amounts only to an average of about 30*s*. per acre, though of course many farmers use more.

Throughout the district there are several exceptions to the general rule. One man on a Dove-side farm, who used to have all his land in grass and milk a very large herd of cows, has completely altered his farm and for the last twelve years has grown 300 acres of corn every year on the same ground, without any apparent disease problem, perhaps because he astonishes the natives by ploughing to a depth of 22 inches! Further south, as I have said, the arable tradition becomes stronger, possibly owing to the fact that farms generally are larger, many having up to 100 acres of cash crops. Indeed one farmer grows 100 acres of potatoes, chitting all his maincrop seed in the best Lincolnshire style, and regularly obtains yields of 12 tons and more. A farmer near by has installed irrigation equipment, the rainfall being about 25 inches. He takes the water from the Trent, which is, of course, also the source of water for a string of three power stations in the district.

Another farm without a dairy herd is to be found at Walton-on-Trent. Here the farmer has very successfully pioneered the fattening of cattle on a diet entirely of self-fed grass silage, and many have been finished at over 8 cwt between 15 and 18 months of age. This has been accomplished without any supplementary feeding from about 6 months old. Incidentally, whilst excavating the silos the farmer came across rows of skeletons buried near the stack-yard. Local archaeologists tell us that these are the casualties from a battle between the Saxons and the Danes.

The area also has a specialized market-gardening district around Melbourne. Here the soil has become artificially darkened by generations of gardeners treating their land with soot. One story about the rise of Melbourne as a market-gardening area is that the main industry was originally the production of thorn quicks, which were sold to the railways for boundary fences during the great age of railway building. Melbourne men travelled all over the country to plant these themselves. When the demand fell off there was a swing to the production of vegetable crops for the rapidly growing urban area of Derby which, in turn, owed its early development to the influence of the railway.

The district is a delightful one, particularly from the point of view of the District Advisory Officer, for despite the universal dairy herd, the variations in supplementary enterprises, management techniques, and soil types, provide many interesting problems.

On our cover we show the Priory Gate to Repton, one of the great English Public Schools, founded in 1557 by Sir John Porte. The modern buildings stand on the site of an Austin priory, parts of which remain incorporated in the school walls.

At the Farmers' Club

Beef from Single Suckling

THE Scottish Borders have built up a great reputation in the last twenty years for the production of suckled calves and beef cattle of a very high standard. At the Farmers' Club on 11th March, Mr. William Hogg described how this spectacular increase in beef production has been brought about.

Originally, store cattle, mostly Shorthorns, bred in the North of England formed the basis of Border husbandry. With the coming of milk recording and the greater emphasis on dairying, that type of beef store deteriorated. Ireland then became the main source of supply, especially as the Irish Government had made available to their breeders the best type of Angus bulls bought in Perth. "At that time," declared Mr. Hogg, "I think the Irish Angus cross store cattle that came over here were of a higher standard than they have been of late years!" Possibly that gave Border farmers the idea of breeding their own stores, a system that can fit in well with sheep farming, as Mr. Hogg's own experience at Clackmae has demonstrated.

Clackmae is a 740-acre farm lying at 600–900 feet, most of it cold boulder clay—a typical Border sheep farm which, said Mr. Hogg, "would have been a marginal holding but for the efforts of my forbears, the pre-war lime subsidy, and heavy stocking with breeding cattle without reduction in the sheep stock." It carries 640 North Country Cheviot breeding ewes, with 200 ewe and 40 tup hoggs, the numbers being kept fairly stable.

Mr. Hogg said that before 1926 he had been breeding Lincoln Red Shorthorn cattle, rather similar to Scottish Shorthorns, and selling the steers fat at 20 months old. When in 1926 the advantages of the Angus cross steer had become known to the local butcher, the decision was made to change the stock at Clackmae. Mr. Hogg bought an Angus bull which, when crossed with the Lincoln Red cows, produced very successful results—good quality black calves with plenty of growth about them. The best of the cross-bred heifers were again crossed with an Angus bull, giving three-quarters-bred Angus of great quality, and with the growth rate still satisfactory. "Along with a few others I started to sell calves in St. Boswells," said Mr. Hogg, "and from that the St. Boswells and other calf sales have grown to be a great autumn feature of our country."

The next step was to buy a Scottish Shorthorn bull to put to the three-quarter-bred Angus cows. Since then the breeding programme at Clackmae has continued on the same lines. A pedigree Angus herd was started in 1928 to make use of the Angus bulls. Today the cattle stock comprises 35 Aberdeen-Angus pedigree cows, and 85 cross-bred cows. Every year 20 of the best cross-bred heifers are retained and they and the Angus heifers are all served at 15 months of age. The cross-bred cows are never housed after their two-year-old heifer year. Calving begins in January. In a normal season the cows live on grass till well on in December, and then go on to silage, hay and a few

turnips until new grass is available. "With my method," Mr. Hogg explained, "I have tried to build up a stock of beef cows that can be trusted to produce the right type of beef calf, and have become acclimatized to the land and conditions they have to live on—quite a point on much of our higher land." In addition, there is a low ground farm at Kelso where 120 yearling steers are fattened, mainly off grass, for sale before Christmas the following year at 20 months, aiming at an average 9½ cwt overall.

The alternative to this self-contained system, in which only stock bulls are bought, is the more popular Border practice of purchasing high-class Angus cross heifers from Ireland, which gives a higher turnover. Shorthorn-Galloway heifers are preferred for more exposed areas. These replacement heifers are generally bought at an age and strength that can be served to produce sale lots of calves more or less of an age. The Irish Angus cross cow is ideal for producing the big, strong, well-fleshed calf to be seen in all the good Border calf sales. Outstanding results, such as those obtained by Mr. Robinson of Snipehouse and Ditchburn, are ensured by selecting the breeding females with great care and buying a first-class Angus bull. Whilst Angus breeders have no cause to be complacent, and we hear a lot about progeny-testing these days, Angus bulls can at least produce calves that at 10 or 20 months represent weight for age and quality, admired by beef cattle experts from all over the world.

Mr. Hogg commented on the emphasis placed on size by some commercial breeders when selecting a bull. "The real answer is the medium-sized bull with a good wide top and hindquarters, well set on good legs; the high-standing ones don't often have these points."

Methods of providing winter keep have greatly improved on Border farms. Instead of the 70 acres of roots and 140 acres of oats formerly grown at Clackmae, today there are only 30 acres of roots and 60 of oats, with 60 of tripod hay and 25 of silage made from green oats or grass.

Beef production in the Border country has benefited greatly from the Marginal Land Assistance Scheme. The present Government's policy of removing this sound form of investment in these uplands seems extremely short-sighted in Mr. Hogg's view, but the best long-term form of assistance to high-lying boulder clay land has been the lime subsidy.

Although there is a lot of single suckling practised on good arable farms, doubtless owing to the high price of store cattle, it is difficult to see how this can be economical. "There is no doubt that you can have land that is too good, and leys that are too flush for the single-suckled herd."

Sylvia Laverton

★ NEXT MONTH ★

Some articles of outstanding interest

ARTHUR S. RICKWOOD *by P. E. Cross*

LAMB WINTERING SHEDS *by L. J. Williams*

ALTERNATIVE HORTICULTURAL CROPS FOR CORNWALL *by F. W. Shepherd*

SMALL FARM ON HEAVY LAND *by Ian G. Reid*

In Brief

SILENT REVOLUTION OF ARTIFICIAL INSEMINATION

The total of ten million cattle bred by artificial insemination at M.M.B. centres over the past fourteen years is a most impressive figure—evidence, in the words of Dr. Joseph Edwards, of "a silent scientific revolution in agriculture, as well as a technical achievement". Starting at Beccles in 1944, the number of A.I. centres has steadily increased to the present figure of twenty-four, servicing the whole of England and Wales. Some of these are now very large and have been responsible for inseminating 100,000 cows and more a year. In 1957–58, sixty per cent of cattle in England and Wales were bred by A.I. Bulls of fifteen breeds are kept at the M.M.B. centres, grouped as four dairy, four dual-purpose and seven beef.

Reporting this progress during the past fourteen years, the Board claims that for every 100 cows inseminated approximately 67–70 are got in calf first time. This is the average result. Yet at any centre at any time there are a few *herd* results as low as 25 per cent and some as high as 100 per cent. The fact that semen quality and techniques are the same throughout means that these variations are due to conditions *within* herds, and these may be nutritional, hormonal, pathological or the result of faulty management in detecting œstrus.

A study of the fertility rates of more than 1,000 bulls at Board centres, each of which was used to inseminate no fewer than 500 cows in one year, has drawn attention to the existence of a "fertility barrier" imposed by the female side of the conception partnership. No bull is able, among a large cow population, to exceed a 75 per cent result. This is thought to be due to early embryonic death following conception, and the causes of this constitute a worthwhile field for physiological research.

As commercial A.I. has gathered momentum, so has the bull population fallen. In 1945, the number of bulls in service in England and Wales was 108,676; in 1958 the figure was 55,200, the drop being sharpest, of course, among non-pedigree animals.

BOAR SIRE PERFORMANCE TEST

"Probably the most important factor in improving efficiency in the pig industry is the selection of sound breeding stocks", said Mr. W. T. Price, Principal of Harper Adams Agricultural College at the first BOCM Boar Performance Test Prize-giving in London on March 10th. "Obviously we must have good conformation, but after that we must rely on the 'utility' pedigree (which is made up of record of performance) rather than solely on ancestral pedigree or showring awards. It should be remembered that after ten generations there is only one-thousandth part of the original parents' blood remaining in an animal.

"Performance testing is an assessment of the pig while it is still alive so that a young boar can, if desired, be kept for breeding. It speeds up the process of selection and there is no reason why the test cannot be carried out on the ordinary farm to give the owner a comparison of the merits of his breeding stock. Growth rate is measured by fortnightly weighings. The food conversion is determined by the amount of food fed in relation to the total liveweight gain, and a partial assessment of carcass quality is made by instruments now available for the purpose. These qualities are likely to be passed on to the offspring with fair regularity. Also, the fast-growing pig will usually show the best food conversion

figure, providing the carcass quality (leanness) is good. This pig will usually give a carcass of a good quality, tender meat with firm fat.

"The time has come when we must revise our ideas on grading for carcass quality. We have thought in terms of 'too much fat' but, in my opinion, it has got to be 'how much lean?' There is a tendency for the very long pigs to give carcasses lacking in quantity of lean meat, particularly the eye muscle. This can be exaggerated when excessive restrictive feeding is practised. It may be necessary to measure the back fat in relation to the weight of carcass. It is claimed that the heavy pig (that is a pig of some 60 lb live weight heavier than the bacon pig) gives a lean meat of better flavour and texture because it contains more fat in the carcass."

Twenty-nine boars were under test at the Stoke Mandeville Testing Station, where they were received soon after weaning, starting at 70 lb live weight and finishing at 200 lb. On average, they reached their target weight in 163 days, a daily average gain of 1·61 lb at a food conversion rate of 3·25. Maximum shoulder fat was 47 mm and maximum rump fat 32 mm.

NATIONAL PIG RECORDS

On 1st April, the Pig Industry Development Authority took over responsibility for pig recording from the Ministry of Agriculture, Fisheries and Food. The Ministry will summarize the results of litters born on or before the 31st March, 1959. Details of the change are being sent to each breeder who is at present recording under the Ministry scheme.

National Pig Records was started by the Ministry in October, 1954. Membership has steadily increased, and during the current half-yearly period some 3,000 members will have recorded about 35,000 litters.

The results achieved by recorded litters have shown consistent improvement. For example, the number of pigs reared per litter has increased from 8·0 to 8·6; and the average litter weight at 8 weeks from 258 lb to 315 lb.

HYDRO-COOLING

Hydro-cooling is a recent development in this country. It involves the immersion of certain vegetables and fruit in ice-cold water to extract field heat and improve the condition of the produce on arrival in the market. Refrigeration firms in this country have designed and are building various types of hydro-cooling plants to suit both small and very large growers.

A grower's views on hydro-cooling were expressed in Evesham recently by Mr. L. H. Jerram, General Manager of Messrs. J. M. Stokes Ltd., Evesham. He thought that hydro-cooling operators must take great care with the length of time of cooling, and to do this plenty of quick-reading thermometers are essential. Cabbage cut very early in the morning need immersion for only a few minutes, but later in the day, as the field temperature of the cabbage goes up, a much longer immersion period is necessary. Hydro-cooling must not be hurried and it is possible to draw up a chart which relates the period of immersion to the cabbage temperature. Mr. Jerram advised hydro-coolers to be very careful with the water they use, for one cannot afford to run the water away after each immersion. Using the large batch type cooler, his firm have found a change of water every other day to be satisfactory, except when the cabbage is muddy, which necessitates a change of water every day.

Carrying out private experiments with different methods of transporting hydro-cooled cabbage to the markets, Messrs. J. M. Stokes found that for long distances hydro-cooled cabbage in an ordinary ventilated rail truck arrive in better condition than non-cooled cabbage in a similar truck. When dry ice is suspended from the top of the rail truck, the hydro-cooled cabbage arrives in even better

condition. Hydro-cooled cabbage transported in an insulated meat van gives the most spectacular result of all, although this method is rather expensive. With road transport, sheeting is essential, and double sheeting preferable. Growers who are hydro-cooling produce, insisted Mr. Jerram, must set certain standards to ensure that produce labelled "Hydro-cooled" has been properly cooled.

PLANTING DENSITIES OF TOMATOES AND LETTUCE

Density of planting has a marked effect on the yield, size, quality and profitability of many horticultural crops. From the grower's point of view, some effects are opposed, and to obtain maximum profit, it is necessary to strike a balance. The main effects of spacing are well illustrated by recent work carried out on glasshouse tomatoes, heated glasshouse lettuce and self-blanching celery by the N.A.A.S. Experimental Horticulture Stations.

As regards tomatoes, when plant densities were between 9,500 and 21,000 per acre yield increased progressively with increased density. At the closest spacing there was no evidence of any falling off of yield increase, except in the case of very vigorous varieties such as Ailsa Craig. Close spacing also produced a slightly earlier crop. Above a population of 14,000 an acre the additional cost of labour necessary to keep the plants trimmed and pruned began to exceed the value of the extra crop, and it was unprofitable to increase yield further. Below a density of 14,000 per acre there was an increasing loss of yield, due to loss of population. The right kind of density is about 14,000 plants per acre, a result which confirms the general practice of growing six rows per 15 feet width of glasshouse and spacing the plants 14–15 inches apart in the rows.

Lancashire growers of heated glasshouse lettuce have long maintained that although a wide spacing of 9×9 inches will produce a larger lettuce of excellent quality, a closer spacing of 7×7 inches will produce a much higher yield of slightly smaller lettuce, with a resulting large increase in profit. Trials have shown that good quality lettuce can be produced at all densities between spacings of 6×6 inches and 9×9 inches. At 6×6 inches the yield was 65 per cent greater and the gross value 80 per cent greater than at 9×9 inches. Close spacing produces a smaller lettuce with a rather elongated heart, and once maturity is reached deterioration is rapid unless the crop is quickly cleared. A spacing of 7×7 inches is best in commercial practice.

Self-blanching celery reacts similarly to tomatoes and lettuce. Close spacing gives the highest yield, earlier maturity and better blanching, but the individual sticks are smaller and the crop deteriorates rapidly if not quickly cleared at maturity. Spacings between 9×9 inches and 10×10 inches are best.

G. F. Sheard

DAY-LENGTH CONTROL IN AMERICAN FLOWER PRODUCTION

Whilst the growing of chrysanthemums all the year round is at present receiving wide publicity, less is known about the effects of daylight on the flowering of some other crops.

Poinsettias and kalanchoes are both "short day" plants which will not initiate flowers until the autumn. In a normal season poinsettias start to form flower-buds around mid-October and produce their showy scarlet bracts in time for the Christmas market if temperatures are maintained around 60°F. In some seasons, however, the weather is unusually bright and cloudless in October, and this has the effect of lengthening the day and so delaying initiation. Likewise a cloudy autumn may hasten bud formation, and growers have difficulty in holding plants for Christmas (at low temperatures root diseases tend to be serious). Thus to be sure of hitting the Christmas market, some successful American growers apply artificial lights for a fortnight before 10th October and cover with black cloth

for a fortnight after. As with chrysanthemums, a break of 2–3 hours in the middle of the night with ordinary 60 w. lamps suspended above the plants has the same effect as a long summer day. Black cloth is drawn from about 6 p.m.–8 a.m.

With kalanchoes under normal conditions, flowers are initiated around October 1st, but do not open till January, even if maintained at a temperature of 60°F. To get them in flower for Christmas, it is necessary to provide short days for a month from September 1st if temperatures are kept at around 60°F. If the crop is to be grown cooler—say 50°F. at nights—it is necessary to start using black cloth around August 1st.

China asters respond peculiarly to day-length. In long days they form flowers on long stems and in short days they form rosettes of leaves close to the ground but no flowers. If however, a few long days are followed by short days, they flower very quickly on short stems—too short to be saleable. Thus to obtain flowers in the early spring months when prices are good it is necessary to grow them under long days throughout. This is practiced commercially in the United States.

It is rather surprising to find that the flowering date of the cattleya orchid is controlled by some American growers. Cattleyas are "short day" plants which normally flower too early for the lucrative spring wedding trade, and to delay flowering it is possible to use lights during the autumn nights. But, this crop has not proved so amenable as the chrysanthemum, the main complication being the effect which temperature has on the flowering response of orchids. Varieties of cattleyas also differ in their reactions to both light and temperature. Of course, temperature also has a marked effect on the flowering of other crops such as chrysanthemums, and although American colleges and commercial firms have published definite schedules for the grower to follow, he still needs to have a scientific turn of mind to be successful with these new techniques.

E. N. Powell

FOREST TREE SEED ASSOCIATION OF ENGLAND AND WALES

A move to improve the quality of all species of forest trees grown in this country, by encouraging the use of seed and plants of the best known origin is the declared aim of a Forest Tree Seed Association for England and Wales, similar to that already functioning for Scotland. The rules and formation of the Association are in the hands of a Management Committee, comprising: Lord Bradford, Major Charles Graham, A. E. Aitkins, P. A. Hutt, W. H. Rowe, E. C. M. Stewart, J. R. Thom, and J. B. Stocks. The Secretary is E. S. J. Hinds, Forest Tree Seed Association for England and Wales, Forestry Commission, 25 Savile Row, London, W.1.

A.L.S. DIRECTORSHIP

Mr. D. Christy, C.B.E., who became the Director of the Agricultural Land Service in April 1955, retired from public service on 31st March. He has been succeeded by Major E. S. Dobb, formerly the Deputy Director.

Mr. D. A. Hole, N.D.A., F.R.I.C.S., Regional Land Commissioner at Reading, became Deputy Director on 1st April.

NEW PEER'S TITLE

The barony conferred upon Sir James Turner in the New Year Honours has been gazetted by the name, style, and title of Baron Netherthorpe, of Anston in the West Riding of the county of York.

Short Guide to the Annual Review, 1959

THE results of this year's Annual Review and Determination of Guarantees were published in the White Paper (Cmnd. 696)* on 19th March.

Agricultural net output in 1958–59 is expected to be 61 per cent higher than pre-war. This is only one point below the revised figure of 62 per cent above pre-war for 1957–58, which was itself a record. But for the appalling weather, there would probably have been a slight increase. The bad weather was, however, reflected in the yields of cereal and potato crops, and in a temporary fall in the production of milk. Production of beef and lamb has also fallen temporarily. On the other hand, there has been a continued rise in the number of calves retained for beef and in the sheep breeding flock. Production of pig meat has increased, but the breeding herd has been declining. The production of eggs has increased substantially.

The actual net income for 1958–59 is forecast at £327 million—£27¼ million less than the revised figure for 1957–58 of £354¼ million. This fall is due to the weather: in normal weather conditions the forecast would have been £360¼ million. The total cost of agricultural support for 1958–59 is expected to be about £248 million, as compared with £284 million the previous year.

The prices of goods and services used in agriculture have increased by about £11¼ million for Review commodities—about the same increase as last year. This excludes feed costs for pigs and eggs, which are reflected automatically in adjustments to the guarantees. The effects of increasing efficiency can be estimated only broadly, but in the Government's view efficiency is continuing to increase on the scale at which it has been assessed previously—£25 million a year for Review commodities, although in 1958–59 the effects have in part been masked by the weather.

The main aim is still a steady improvement in the industry's competitive position and in its adaptation to the needs of the market. The Government believe that no further expansion of gross output is required; and any further expansion of net output must be achieved through reducing unit costs by improved techniques and better farm management. The particular aims should be:

1. The maintenance of the arable acreage at roughly its present size, but with less emphasis on wheat and rye than on barley and other feed crops.
2. Greater reliance on home-produced feed for livestock. (Imports of feedingstuffs are forecast to rise from 5·4 million tons, costing nearly £120 million, in 1957–58 to 6·1 million tons, which may cost about £140 million, in 1958–59.)
3. Production of more beef of the quality wanted by the market.
4. Reduced costs in lamb production in view of market prospects.
5. Continued reduction in the costs of pigmeat production and further effort to satisfy market requirements; and
6. Production of fewer eggs, and of less milk than is at present in prospect.

The total value of the guarantees will be increased by £3 million. This will provide for the cost of the new assistance schemes for smamll farmers (£6 million) and for some reduction in the level of the guarantees for those commodities where this is most needed at the present time.

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* H.M. Stationery Office, price 1*s.* 3*d.* (1*s.* 5*d.* by post).

Guaranteed Prices

Note: For the bases of the prices given below and other particulars of the guarantee arrangements see the Additional Details of Guarantees in Part II of Appendix V of the White Paper (Cmnd. 696).

Livestock and Livestock Products

Commodity	Guaranteed Prices 1958–59 as determined after the Annual Review, 1958	Price change compared with the 1958 Annual Review Guarantee	Guaranteed Prices 1959–60 as determined after the Annual Review, 1959
Fat cattle (per live cwt)	157*s.* 0*d.*	No change	157*s.* 0*d.*
Fat sheep and lambs (per lb estimated dressed carcass weight)	3*s.* 3½*d.*	No change	3*s.* 3½*d.*
Fat pigs (per score deadweight)	44*s.* 9*d.* (subject to a reduction of 1*d.* per score in Northern Ireland and, for part of the year, in Great Britain) related to a feed price of 26*s.* 3*d.* per cwt.	No change	46*s.* 9*d.* (subject to a reduction of 1*d.* per score in Northern Ireland (see note (*a*)). This guaranteed price for pigs is related to a feed price of 28*s.* 3*d.* per cwt and is equivalent to 44*s.* 9*d.* per score related to the 1958–59 feed price.
Eggs—hen (per dozen)	4*s.* 0·95*d.* (subject to a small reduction in Northern Ireland) (see note (*b*))	−1*d.*	4*s.* 0·95*d.*
Eggs—duck (per dozen)	2*s.* 5·70*d.* These prices were related to a feed price of 25*s.* 9*d.* per cwt.	−0·70*d.*	2*s.* 6*d.* These prices are related to a feed price of 26*s.* 11*d.* per cwt and are equivalent to 3*s.* 11·95*d.* per dozen for hen eggs and 2*s.* 5*d.* per dozen for duck eggs related to the 1958–59 feed price.
Wool (per lb)	4*s.* 8½*d.*	−2*d.*	4*s.* 6½*d.*
Milk (average per gallon)	3*s.* 1·70*d.*	No change	3*s.* 1·70*d.*

Crops

Commodity	Guaranteed Prices for 1958 Harvest as determined after the Annual Review, 1958	Price change compared with the 1958 Annual Review Guarantee	Guaranteed Prices for 1959 Harvest as determined after the Annual Review, 1959
Wheat (per cwt)	28*s.* 1*d.*	−6*d.*	27*s.* 7*d.*
Barley (per cwt)	29*s.* 0*d.*	No change	29*s.* 0*d.*
Oats (per cwt)	27*s.* 5*d.*	No change	27*s.* 5*d.*
Rye (per cwt)	22*s.* 1*d.*	−6*d.*	21*s.* 7*d.*
Potatoes (per ton)	229*s.* 0*d.* which on the new basis (see note (*c*)) is equivalent to 254*s.* 0*d.*	No change	254*s.* 0*d.* on new basis
Sugar beet (per ton, 16·5 per cent sugar content)	130*s.* 6*d.*	No change	130*s.* 6*d.*

Notes on Price Tables

(*a*) As in 1958–59, the guaranteed price for pigs for 1959–60 in Northern Ireland is subject to a reduction of 1*d.* per score, to take account of certain expenditure incurred on pig progeny testing stations in that country.

(*b*) The guaranteed price to the British Egg Marketing Board for hen eggs qualifying for the guarantee in Northern Ireland was subject to a small reduction in 1958–59 in order to recover from the industry certain costs incurred on a poultry progeny testing scheme in that country.

(*c*) As already announced the support price of £11 9*s.* per ton for the 1958 crop is equivalent to a guaranteed price of £12 14*s.* per ton under the new guarantee system that is to be introduced for the 1959 crop.

Book Reviews

Farm Business Management. D. G. PEARCE. Oliver and Boyd. 15*s*.

The author of this book is the only farming member of the British Institute of Management. Since he is also a notable farm manager, his qualifications appear to be admirably suited to writing a book on farm business management. Although it is pleasing to record that the contents fully reflect this, the proviso must be made that it has been written in a style that few farmers will be able to follow with ease.

Mr. Pearce emphasizes in his introduction that farm management embraces the complementary subjects of technical and business management, and that the majority of farmers give far too little time to a consideration of the latter. The adoption of new techniques will continue to be accompanied by unsatisfactory profits until this is remedied.

The book is divided into three sections, "Accountancy", "Budgeting" and "Control". As the author so correctly observes, mention of the first is anathema to most farmers, and yet without a sound accounting system, and a willingness to use the information so recorded, effective business management is impossible. It is suggested that farmers should not have to wait for their accountant's statement to discover what profit (or loss) has been achieved, but should be able to predict the final result long before the end of the year.

The second section describes the methods and explains the principles of planning ahead. The profitability of the past year is first examined and compared with standards which may, for instance, be supplied by a university, or be targets erected at the commencement of the year. After this has been done certain weaknesses and strengths will reveal themselves, and consideration of these will greatly assist planning for the following year. This budgeting must include consideration of the financial resources available, and indeed Mr. Pearce suggests that farmers would be well advised to construct not only a budgeted profit and loss account but a balance-sheet also.

Accounting and budgeting will be largely wasted unless control is considered, and Part 3 discusses the organization of operations and jobs involved in a farm programme. Unless the year's activities are planned in advance, it is most unlikely that they will be co-ordinated as economically as is desirable.

This book is a valuable addition to the growing number of publications dealing with farm management; but if a farmer reader wishes to obtain full value from it he would be well advised not to defer his reading until the end of a busy day.

J.E.H.

A Country Window. RICHARD CHURCH. Heinemann. 16*s*.

It is not often nowadays that one is able to welcome a book for its literary worth alone, but the value of Mr. Church's *A Country Window* rests entirely on that merit. This is a collection of sixty-six short essays selected from his series of weekly articles in *Truth*, and for the most part they have their setting in the lovely countryside of Kent. Nature and Man provide Mr. Church with his raw material, often commonplace enough, but it is in the keenness of his observation, the imagery of a poet's mind and the skill of his writing that make practically every one of these a sheer joy to read.

Thus he sees the act of ploughing as "mankind's most emphatic gesture of hope and defiance, a confiding of the present to the future", the tractor "adding its voice to the choir of nature", the camp-following sparrows "anonymous brown in the furrows". He recalls "the elusive fragrance of the after-glow of summer rain when day begins to withdraw into a twilight that is half preparation for another day".

He sees colour and pattern, harmony and discord. Merely to scratch the surface of Mr. Church's prose is to reveal both poet and philosopher—and hence the man himself.

S.R.O'H.

Grouse: Shooting and Management. RICHARD WADDINGTON. Faber and Faber. 30*s*.

Richard Waddington's knowledge of Scottish grouse moors is unsurpassed, and thanks to his untiring efforts his own moor has been kept in exceptionally good condition. His book is a welcome guide for all interested in grouse shooting, and should help to preserve moors from the decline which has taken place in many parts of the British Isles. All who love grouse moors and the sport they provide should read it.

The most important chapters are those dealing with grouse ground and moor maintenance: these should be studied very closely if moors and grouse stocks are to be improved. The key to the problem of improving stocks is ample food for grouse and sheep—which means plenty of young heather. Doubtless few moors are sufficiently burned, and the area left unburned one year owing to bad weather is seldom made up in successive years. Success is much more likely after adequate burning, and there will be a minimum of disease.

Most English moors are smaller than those in Scotland, the majority being under 10,000 acres and many under 5,000. Owners of these moors, especially on the Pennine range, possess only sporting and grazing rights, and some do not even control the grazing. Public authorities often own the water and drainage rights, and reservoirs occupy large areas.

It is generally agreed that a number of sheep are advantageous, but unlimited sheep rights have been known to ruin a moor so that neither sheep nor grouse can thrive. The only remedy in such cases is legislation to control the grazing. At present there is no means of doing so.

The chapter on hand-reared grouse is most interesting, and opens up a possibility of improving depleted stocks; no doubt further experiments will follow the encouraging report. Since the grouse disease inquiry of 1910 little hand-rearing has been undertaken: I found then that success was best achieved by wiring-in part of the moor.

Chapters 9–14 deal with driving, organization and finance. Moors differ so much in size and character that figures must vary enormously. English moors, being generally smaller, require fewer beaters, less transport, and are correspondingly cheaper to run. Experience shows that in an average year the sale of surplus game pays for beaters.

The importance of flanking (Chapter 12) cannot be overstressed. Drives are too often spoilt by bad flanking: it is difficult to get men to realize that they should be completely unseen until they are required to turn birds to the guns. Chapter 16 on shooting technique must be of special value to beginners. I believe that the best shots do not know why they shoot well. A good eye and, as the writer says, "speed of action", are the keynotes.

W.T.L.

Parasitic Animals. GEOFFREY LAPAGE. Heffer. 25*s*.

That a second edition of this most interesting and readable book has been produced, with so few alterations from the original, supports the favourable impression which it created on its first appearance. Dr. Lapage has taken the opportunity offered by the reprinting to make a few minor corrections to the text, and to revise parts of it which have been shown to be inaccurate by observations made during the past eight years. A list of publications has been added to help readers whose interest has been aroused, and who wish to increase their knowledge of this field of biology. Generally speaking, however, the book remains unchanged.

A wide variety of parasitic animals is discussed, including many which are of importance in agriculture; their life histories, often rather complicated, are illustrated by means of suitable examples, and the author has taken pains to explain the special relationship which exists between parasites and their hosts. An awareness of this relationship is of importance to anyone who is concerned with the diseases of farm animals, as many are caused by parasites.

As the author intended, this book will continue to give an outline of the general principles which govern the lives of parasitic animals. This will be appreciated by the ever-increasing number of students, whose training in the various aspects of biology is often so detailed that it is difficult for them to gain a wide view of the subject, and by the general reader, who will find much of interest in its pages.

The new publishers are to be congratulated on the improved appearance of the book and, in particular, on the improvement in the clarity of the many excellent black and white illustrations. *S.F.M.D.*

The County of Anglesey—Soils and Agriculture. Memoirs of the Soil Survey of Great Britain. E. ROBERTS. H.M. Stationery Office. 10*s*. (10*s*. 8*d*. by post).

The publication of this memoir ends an important chapter in the history of the Soil Survey in Great Britain. It was in Anglesey and the surrounding areas that the late Professor G. W. Robinson—pioneer of modern soil survey methods in this country—gradually evolved, in collaboration with colleagues in other parts of Britain, the methods of survey work in use today. And, as stated in the preface to the book, the island has been a training ground for soil workers now scattered widely over the world. It is unfortunate that Robinson did not live to write the memoir himself, as the field work had been completed at the time of his death. However, the Soil Survey Board were able to obtain the services of Mr. Evan Roberts, who for many years had been an active collaborator in the field work. He has made an excellent job of it.

The memoir has an interesting introduction on the physical and climatic features of the island, and an excellent chapter giving a brief account of its complex geology. Another chapter deals with the agriculture pattern in the past and present, but this is overweighted on the historical side. The short chapter on soil formation, classification and mapping gives the reader a general account of the methods used today for soil survey. The main unit of classification is the soil series, which depends on similarities in parent material, conditions of formation, texture, drainage and other properties. In all, 46 different soil series have been recognized and mapped.

In Chapter IV, which might be regarded as a comprehensive catalogue of the soils of the area, a detailed account of each series is given with comments, in most cases, on their agricultural use and productivity. For a few of the more widespread series the results of recent manurial experiments are also quoted. Readers interested in the descriptions of typical profiles and their characteristics will find Appendices I and II most informative.

With the memoir is a coloured soil map (1 inch to the mile). The staff of the Soil Survey and Mr. Roberts are to be congratulated on the excellence and clarity of this map, which shows the distribution of the soils on Anglesey and a part of the adjoining mainland of Caernarvonshire.

The memoir and the map will obviously be of great interest to agriculturists, advisers and those engaged in agricultural and rural education in North Wales. It should also have an appeal to a wider section of the public, particularly those who are interested in the relationships between soils and rural communities.

R.W.

Experiments in Progress, No. 10. (Annual Report for 1956–7.) Grassland Research Institute. 7*s*. 6*d*.

An impressive amount of fundamental research on the grass crop is in progress at the Grassland Research Institute, and the recently published annual report must give much food for thought to all whose livelihood is inextricably interwoven with grass. A prefatory note by the Director, Dr. William Davies, outlines the essential features of the work and the main lines of investigation.

Experiments in progress to evaluate the merits of species, strains and seeds mixtures are described, together with methods being tried out to extend the grazing season by management and manuring. Interesting results are recorded on such questions as the provision of foggage for winter grazing and the autumn management of a ley for early bite.

The work of the Animal Agronomy Department is devoted to measuring the output of grassland in terms of beef, mutton and lamb. Of especial interest are the trials comparing methods of calf-rearing, including rearing at pasture. These indicate that the hazards of climate have been over-emphasized in the past and, if relatively worm-free pasture can be provided, good growth is maintained with youngsters outdoors in winter. In a comparison of various methods of calf rearing, the best results were obtained from calves at pasture having normal bucket feeding on milk substitute, with hay and some crushed oats fed after thirteen weeks of age. This result was secured despite periods of snow. The cost of rearing store beasts or replacements for the dairy herd is of supreme importance, and here, obviously, is a line of investigation which may lead to revolutionary changes in our normal management procedure. The results to date certainly evoke much pondering on our part and cast doubt on the necessity for feeding expensive supplements, since, by the

end of the grazing season, outdoor-reared calves were as heavy as those which had been multiple suckled, and 80–120 lb heavier than bucket-fed calves reared indoors.

The influence of ley management on the crop-producing capacity of the soil forms the basis for a good deal of critical study in another department, which also has under investigation the question of irrigation.

A number of special articles by members of the staff are included, summarizing the results of some of the trials being carried out, and these are likely to be of wide interest.

Here is a publication which should be in the hands of all research workers and advisory officers whose work involves grassland problems, for it is likely to be of immense value and interest to them and, indeed, offers ideas for many lines of further investigation. For most farmers the academic nature of the work and the vast array of experimental data recorded, which is often difficult to translate into terms of normal production of milk or meat per acre, rules out a study of the publication. This is unfortunate.

To supplement this report there is an obvious need for a further publication written in readily understood terms, related to normal practice, and which could well include work on grassland being carried out at other research centres in the country. Such a publication would be eagerly perused by all those farmers who intend to meet the challenge of rising costs and, who can foretell, falling prices by the more efficient use of this superb crop.

H.I.M.

An Economic Study of the Broccoli Crop in West Cornwall. (University of Bristol, Department of Economics Report No. 109.) HELEN M. COLES. *5s.*

Periodically there is a need, in all businesses, for a survey to see if new methods can cut costs and increase net returns. In large urban undertakings this may be done individually for a single company; in agriculture the units are much smaller and such surveys must cover a representative sample of farms of a given type.

This fifty-page booklet reports on a five-year investigation of this type into one of the most important West Country vegetable crops. Here, through the eyes of an economist, is a careful survey of the state of a crop produced mainly on the shores of Mount's Bay, but which spread quite widely from there before and during the second world war.

The report sets out much background information about acreages involved, competing vegetables of other kinds and from other countries, the weather over quite a long period, and other factors affecting the industry. The survey has yielded information about distribution, sizes of holdings, the costs of every item needed to produce the crop and the returns obtained.

From the many useful tables conclusions are drawn which bring out the present difficulties. The climate, which on the undoubted evidence presented has been worse in Cornwall since the last war, greater competition from other brassicas and from much larger imports are important factors outside the control of the grower. There were large variations between the costs and returns on the various holdings which contributed to this survey, and it is this information which will be of great value to these, and other, growers. By studying his own costs and returns, and comparing them with the best, the average and the worst, the grower should be able to see where he could improve his methods to the best advantage.

Although restricted to one crop in a favourable climate, this report should be of interest to many vegetable growers and to economists and advisers in horticulture. It will certainly be carefully studied by growers and their advisers in Cornwall, where a well-thumbed copy will no doubt be found in the possession of every thoughtful grower of broccoli.

F.W.S.

The Aberystwyth Strains of Grasses and Clovers. (Leaflet Series S. No. 6.) Welsh Plant Breeding Station, University College of Wales. *2s. 6d.*

In this JOURNAL fifteen years ago, Professor T. J. Jenkin described the growth, form, seasonal behaviour and agricultural purpose of fifteen Aberystwyth varieties. Since 1943, there has been a remarkable expansion in their use throughout the British Isles. The new leaflet brings the list up to date, and at the same time the authors have drawn on experience to enlarge on the agricultural value of the older varieties.

While practical experience has amply confirmed the claims made in 1943, it has also shown that the distinction between "pasture", "hay" and "dual-purpose" types has little meaning wherever there is reasonable control of grazing animals. This seems to have been recognized in the revised version, where emphasis on growth form is confined to the extreme "pasture" type and its adaptation to upland sheep grazing. However, these early concepts of the plant breeders are obviously difficult to shake off. "Hay" and "pasture" types alike serve for ensilage, yet silage is mentioned only twice.

The appearance of this document prompts the question whether all the varieties need be perpetuated. The extreme "pasture" type is probably necessary for situations in which very little improvement in grazing management is practicable. But the case for maintaining two other varieties of perennial ryegrass, cocksfoot and timothy does not appear very convincing.

Forthright comparisons of agricultural value are made between S. varieties and Irish perennial ryegrass, Danish cocksfoot, Canadian and Scottish timothy, and so on. On the other hand, it seems a little unfair on New Zealand Certified perennial ryegrass to refer to S.24 as "unique among the bred grasses" in being both early flowering and leafy.

The leaflet is well arranged for easy reference, and contains a table in which are summarized the main features of each variety. *J.O.G.*

Pig Housing. British Oil and Cake Mills.

Opinions differ on the subject of pig housing, both as to the desirable climatic conditions for pigs of various ages and as to the best ways of achieving those conditions within pig buildings. Here, in a booklet of twenty copiously illustrated pages, is set forth the up-to-date and considered opinion of the Pig Advisory Department of B.O.C.M., which has taken the trouble to experiment in recent years with pig houses for the farrowing, early weaning and fattening of pigs.

Temperature, humidity, insulation and ventilation are all dealt with in a straightforward and highly readable manner, and three whole pages are devoted to cut-away drawings of the actual piggeries which B.O.C.M. have designed and tested on their station at Stoke Mandeville. As a summary of certain valuable research and development in one aspect of British farm buildings, this booklet can be highly recommended.

Copies are obtainable free from B.O.C.M. (Pig Advisory Department), 2 Kingscote Street, London, E.C.4.

N.K.G.

Books Received

British Small-Animal Veterinary Association, Proceedings of First Annual Congress, 1958. H. K. Lewis and Co., 136 Gower Street, London, W.C.1. 42*s.*

Recognition of Diseases and Pests of Farm Crops. Ernst Gram, Prosper Bovien and Chr. Stapel. Heffer. 35*s.*

Dwarf Pyramid Fruit Culture. D. Macer Wright. Faber and Faber. 21*s.*

Horticulture in the British Commonwealth: An Outline, 1958. D. Akenhead. Commonwealth Agricultural Bureaux. 10*s.*

Ecological Processes. Alan Mozley. H. K. Lewis. 9*s.*

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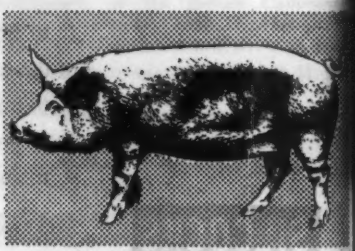

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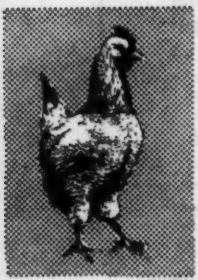

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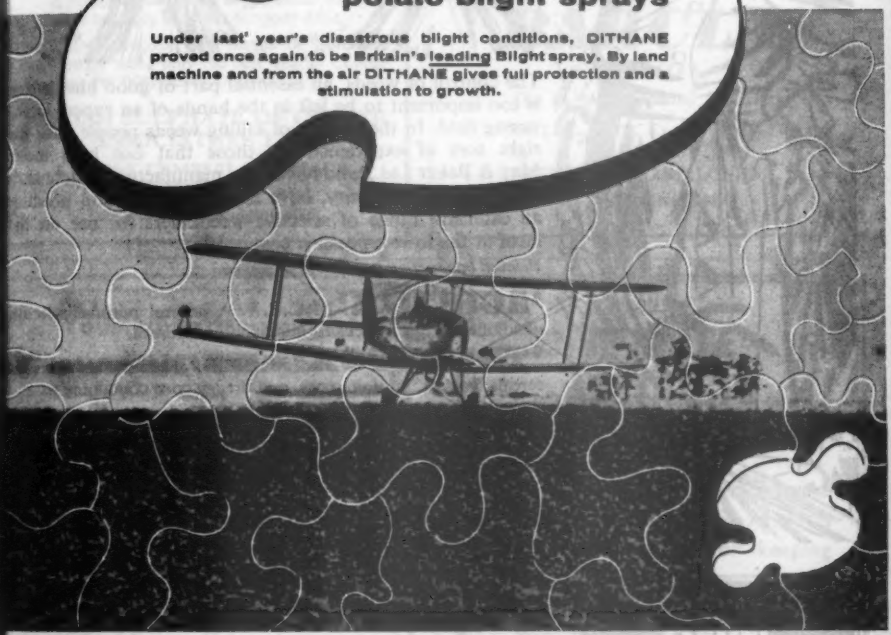

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